

PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE

APPENDIX

TO THE

REPORT

OF THE

PUBLIC WORKS DEPARTMENT
REORGANIZATION COMMITTEE

VOLUME III.

MINUTES OF EVIDENCE

Taken at Rangoon, Bankipore, Allahabad, Lahore and Simla

WITH

APPENDICES.



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PUBLIC WORKS DEPARTMENT REORGANIZATION COMMITTEE.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

PUBLIC WORKS DEPARTMENT
REORGANIZATION COMMITTEE.

At Rangoon, Tuesday, 6th March 1917.

PRESENT.

F. G. SLY, Esq., C.S.I., I.C.S. (President.)

A. T. MACKENZIE, Esq.

SIR NOEL KIRSHAW, K.C.B.

C. S. COBB, Esq., M.V.O.

And the following Co-opted Member.

B. M. SAMUELSON, Esq., M.I.C.E., M.R.S.L., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary.)

The HON'BLE Mr. C. H. WOLLASTON, Chief Engineer and Secretary to the Government of Burma, Public Works Department.

Written Statement.

2,655. (I.) Economy and suitability of methods of execution of public works.—The execution of civil works in the province of Burma is carried out by the agency of petty contractors under the immediate supervision of the Public Works Department. This supervision is intensive, in that all projects are designed and the cost estimated by the Department which also prepares bills of quantities of work done, makes direct cash payments, and submits detailed accounts for government audit.

(a). The petty contractors supply the labour and all local materials. Rates for these items are invited by competition in the open market. As a general rule, the lowest tender is accepted.

(b). Owing to the want of indigenous skilled labour, a large staff of subordinates has to be employed by government; this staff is further necessitated by the large area of Public Works Department divisional charges and the poor communications.

(c). In view of the peculiar circumstances of the case, this relatively large staff of subordinates cannot very well be reduced without impairing efficiency, and I am of opinion that the present system is economical and suitable for this practically undeveloped province.

2,656. (II.) Encouragement of other agency.—It is presumed that, in view of the close supervision exercised, the present system of work is termed "departmental," and that the proposal to employ private agency implies a reduction of the supervising staff.

(2). Granted a good and reliable firm of contractors, it is essential that they employ a sufficient supervising staff to ensure efficiency. It cannot be contended that a smaller supervising staff will obtain the like efficiency. A firm of contractors with summary powers will probably get more work out of a subordinate, but on the

other hand a bigger return on capital expended will be demanded, over and above what would content the petty contractor.

(a). I have no doubt that every executive officer of the Public Works Department would hail with satisfaction the advent of the big reliable contractor; opposition need not be anticipated from them; it is the subordinate who, having to change from his safe tenure under government to the insecure position of a servant under a private agency, would raise every objection to the transfer of service.

(b). It is extremely doubtful whether the big contractor would look at anything but work concentrated in specified areas, where he could ensure efficiency with the minimum of supervision. The mass of petty works and repairs in localities far distant from each other, coupled with the want of communication, would entail departmental or petty-contractor labour necessitating a large staff of lower subordinates.

2,657. (V.) Decentralization, and (VI.) Simplification of procedure.—The executive department of the Public Works Department in this province is, as in many other departments, overworked and understaffed. Each division comprises on the average two civil districts. If the advent of the big contractor with an efficient staff would relieve the Executive Engineer of petty works and repairs, he could concentrate on the more important work, but the opposite is likely to be the case, and in view of the necessary tours he would have to make to supervise departmental or petty-contractor work, his supervision would overlap that of the private contractor.

(a). The executive officer in charge of a division should have greater powers than he has at present under the following heads:—

(i) advances to contractors;

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[Continued.]

- (ii) sanction of allotments under re-appropriation ;
- (iii) local purchase of articles of European manufacture.

(b). The present system of audit is susceptible of simplification. I am of opinion that the complicated system of Public Works Department accounts is quite incommensurate with the ends attained. I would suggest a drastic change, viz., that all Public Works Department divisional accounts be audited by private firms of chartered accountants once or twice a year as deemed advisable.

(c). I do not think the restrictions imposed by the Public Works Department Code are harassing, except as regards the limits of cost fixed for residential buildings. In this province, where rates vary so greatly, it is difficult to keep to this restriction and build suitable houses in dear localities. I would suggest a standard of accommodation for such buildings and not a limit of cost.

2,658. (VII.) Education.—I gather that the intention is, after the introduction of the big contractor, to provincialize the Roads and Buildings Branch of the Public

Works Department. If this surmise be correct, then I am of opinion that the system of teaching and the qualifications at present required in the Indian engineering colleges will meet requirements. Unless the prospects of pay and pension for the provincial services are much improved, it would serve no useful purpose to bring up the standards of the Indian engineering colleges to those of colleges in Britain, unless recruitment to the imperial service is open to the candidates.

(a). As long as there are two services extant—the imperial and the provincial—in the one department, it is unlikely that private agency will recruit the provincial man, except in a subordinate position.

Provincializing a department, or part of a department, may make for economy. I cannot think how the same efficiency is to be obtained if the provincial man has the same qualifications as his imperial brother, and gets but a ratio of his pay. It would be against human nature to expect the same zeal and loyalty from him. A personal grievance, if it have but the semblance of justice behind it, must render the holder less efficient.

The Hon'ble Mr. C. H. WOLLASTON called and examined.

2,659. (President.) The witness stated that he had had 30 years' service in the Buildings and Roads Branch of the Burma Public Works Department, and that he at present held the post of Chief Engineer.

2,660. There were 28 Buildings and Roads and 5 Irrigation divisions in the province, viz., 23 under imperial service officers, 9 under provincial service officers and 1 under a temporary engineer; and the Irrigation divisions also undertook buildings and roads work. In view of the fact that it required time for an engineer to become acquainted with the working of an Irrigation division, an Executive Engineer who after 10 years' service in either of the branches was posted to an irrigation division usually remained in the Irrigation Branch of the Department for the remainder of his service and thus specialized in Irrigation.

2,661. The posts of Sanitary Engineer, Architect and Electric Inspector were the main specialist appointments in the Buildings and Roads Branch. In addition, there was an Inspector of Plumbing who was a specialist recruited from England and he was under the orders of the Sanitary Engineer. All these officers were controlled by the Chief Engineer, Buildings and Roads, and did not receive orders from Superintending Engineers.

2,662. There were 5 municipalities in Burma, viz., those of Rangoon, Akyab, Moulmein, Bassein and Mandalay, and these bodies had charge of all public works within their respective areas. The Public Works Department had charge of all other roads in the province whether metalled or unmetalled and also of all district roads with the exception of two or three village tracks which had recently been constructed by villagers.

2,663. There were no district councils or boards of any kind in Burma, outside the municipal towns. With the exception of the Rangoon Municipality, which employed a large public works establishment, the public works of the other four municipalities were constructed and maintained generally by temporary engineers who were late employees of the Public Works Department, each with a small staff; the construction of any work of magnitude, e.g., a water-works, being carried out by the Public Works Department.

2,664. The collection and consolidation of road metal was executed by petty-contract, but ordinary earth-work was done departmentally by muster gangs who were employed on monthly wages.

2,665. The construction and maintenance of government buildings was not at present entrusted to any agency or department other than the Public Works Department. But from 1905 to 1910 the Police Department undertook the erection and maintenance of their own buildings in the hope that they might effect economy. The results of the experiment had proved un-

satisfactory and consequently all Police buildings had been re-transferred to the Public Works Department.

2,666. The Public Works Department had a central stores in Rangoon, but no workshops, except a small one in the Independent Light House Sub-division. Government had possessed two brickfields at one time, but it had closed down one of these and now maintained only the one at Kokine which was located about five or six miles from Rangoon. Except for this brickfield there was no centre from which a stock of bricks might be distributed all over the province, as cartage in Burma was a very heavy item of expenditure. Hence bricks were generally burnt at the site of works. As the quality of private bricks was inferior it was necessary for government to maintain its own brickfield near Rangoon for the construction of its buildings. The bricks manufactured at the government brickfield were mainly intended for departmental use, but they were occasionally sold to the public when there was an accumulation in stock. The public demand for government bricks was usually so great that the annual outturn of the government brickfield would be insufficient to meet public requirements. He was convinced that private agencies could, if they desired, manufacture bricks of the same quality as those made by government, since the identical agency would be employed in both cases, and attributed the present difference in the quality to the fact that the government supervision was superior to that of private agencies. Private bricks were probably available at a rupee per thousand cheaper than the rate for government bricks, but their quality was inferior.

2,667. The Central Store Depot in Rangoon was treated as a sub-division and was in charge of a temporary engineer with the rank of Assistant Engineer. It had recently been found necessary, however, to place an Executive Engineer temporarily in charge, to put the working of the sub-division on a proper basis. The Stores Depot obtained the requirements of the province by indent on the Director General of Stores and kept them in stock, issuing them to departmental officers according to their needs. He was opposed to the abolition of the depot and to each division maintaining its own stock, as Executive Engineers were not allowed to indent for stores in anticipation of sanction to estimates and it was possible that a particular division might run out of certain articles at a time when they were most needed. There was, besides, the drawback that the India Office took about a year to comply with indents. Articles of European manufacture, e.g., cement, corrugated iron; etc., were not as a rule purchased locally as they had to be indented for, under rule, unless they were required

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[Continued.]

urgently, and the main justification for the maintenance of a separate stores depôt was the necessity for keeping a certain quantity of particular materials in stock, in order to obviate delays.

2,668. A charge of 24½ per cent. was invariably levied on account of departmental charges, when the Department executed work for district funds and municipalities, but remissions were sometimes granted in the case of sanitary and hospital work and when the finances of the district fund did not permit of its meeting the charge. A contribution military work was one that was executed by the Public Works Department for the Army Department for which no provision had been made in the imperial military works budget, and he added that there was no Military Works Department in Burma. All the contribution works referred to in the statement furnished by the local Government had been executed by the Buildings and Roads Branch staff.

2,669. The expenditure on establishment in the Buildings and Roads Branch in Burma varied between 25 to 28 per cent. He could not, without a reference to the establishment charges incurred in other provinces, say why the charges were as much as 25 per cent., but he personally did not consider the percentage a high one in view of the peculiar conditions prevailing in the province. One of these was that no indigenous technical labour was available and this led to an increase in the supervision charges. He had no knowledge of the local conditions in other provinces, but surmised that work in Burma required more detailed supervision than was probably required in provinces in India.

2,670. Though a few members of the upper subordinate staff of the Burma Public Works Department had been recruited from the Insein Engineering School, it had hitherto been the practice to recruit one man of this class yearly from India. An attempt was, however, at present being made to restrict recruitment entirely to the Insein school, and the lower subordinate staff was at present mainly recruited from this source, which was hence practically the sole field for the recruitment of the permanent upper and lower subordinates in Burma.

2,671. The Insein Engineering School had passed through many vicissitudes, and though it had probably existed as a school for about 10 years, recruitment from it to the subordinate establishment of the Public Works Department had been in force only for the past five years. He thought the school had been started in 1860 but it was only within the past ten years that the standard of teaching had been improved. It was premature to pronounce an opinion on the products of the Insein school, and he anticipated that the next four or five years would reveal a distinct change for the better. The Public Works Department had great hopes of the institution and had only last year appointed as head of the school one of its own officers, who had already effected considerable improvements. The majority of the present students were Burmans, but Indians had formerly predominated. The experiment of reserving the school chiefly for Burmans was a promising one and held out great possibilities.

2,672. The experiment under which Deputy Commissioners were supplied with 'local fund overseers' for the execution of public works in districts in Burma had been in force for about 5 to 10 years, and had been abolished 8 or 10 years previously. Such overseers mainly constructed and repaired minor buildings, e.g., small court houses, bazaars and other structures in the district other than residential buildings, the major buildings, e.g., court houses at district headquarters and residential buildings being constructed and repaired by the Public Works Department. The scheme had been abandoned at the instance of the Deputy Commissioners themselves, as they found that the buildings and roads in their charge were fast deteriorating. Some Deputy Commissioners besides had complained that they had not the time, inclination nor knowledge for the supervision of public works entrusted to their care.

2,673. He explained that the percentage for tools and plant was as high as 2 per cent. as petty contractors

generally had no plant of their own and the Department was obliged to supply the plant required for every work of importance as well as tools, even those required for manual labour. The supply of tools and plant was not regulated by the Central Stores Depôt, but plant required for a sanctioned work was purchased and its cost debited to the work, the item being brought on to the divisional tools and plant list at a valuation after the completion of the work provided the plant was in a good and serviceable condition. By this means each division had a small stock of tools and plant, and this was maintained at divisional headquarters. He added that such tools and plant were interchangeable between circles and divisions. The estimates for contribution works contained an allowance for the use of tools and plant, but this procedure was not adopted for government works in which case only special items of tools and plant required for utilization on a particular work were debited. He was not aware whether an allowance was made for tools and plant by accounts officers when calculating the establishment charges. The statement he had furnished showing the cost of building and roads works, however, did not include any charge for tools and plant unless they had been specially charged to a particular work on which they had been used. It was possible, in his opinion, to furnish figures showing the value of tools and plant in stock in Burma, as the Public Works Department had a return showing the information.

2,674. The procedure for the construction of a road was, in the first instance, to send out a small staff of surveyors to survey and align it, and after the necessary data had been collected to frame an estimate in the divisional office. The estimate was then submitted for sanction to the Superintending Engineer, the Chief Engineer or the local Government according to its total amount, and public tenders were invited after sanction to it had been received. A contractor was then selected for the collection of metal and the construction of bridges and the work put in hand after funds for it were allotted. Formerly, it had been the practice to entrust the wood-work in bridges to Chinamen and the earthwork to Indians, since Chinamen were not able to carry out earthwork nor Indians to carry out wood-work, and though it was at present permissible for an Executive Engineer to accept a tender for an entire project including bridges, metal-work, earthwork, etc., generally the several items of work were distributed to various contractors whose capabilities were known.

2,675. Public tenders were also invariably invited for entire projects for the construction of buildings, with the exception of the sanitary and electrical fittings therefor; but the practice was occasionally departed from to a limited extent. For instance, for the construction of the new telegraph office and customs house in Rangoon, separate estimates were framed for the steel-work in the buildings before calling for tenders, as it was necessary to procure the steel from England. Another reason for the departure from the general rule in the two cases he had cited was the difficulty that had been experienced in securing a single contractor to undertake either of the entire projects.

2,676. There were about four or five large firms of building contractors in Rangoon, but as far as he was aware only two of these had tendered for public works, and their tenders were generally very high. He did not know why the other firms had not tendered, and how private firms had erected the large private buildings in Rangoon, but he surmised that the architect selected in each case had recommended a builder to the owner. Private buildings were erected by a single contractor who tendered for the entire project, with the exception of the sanitary and electrical fittings, which latter were given to contractors who had specialized in those two items. He considered it was possible for private owners to entrust the steel-work in a building to a separate contractor as some of the local firms dealt only in steel-work, and could tender at lower rates than contractors who had not so specialized.

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[Continued.]

2,677. No regular system was in force in Burma for the registration of approved contractors. Only a list of contractors was maintained in each division and this was made over by each Executive Engineer to his successor. As it was not circulated in the province, Executive Engineers did not know the contractors employed in other divisions. A list showing the names of those contractors who had proved unsatisfactory was maintained and such contractors were thus precluded from further employment in the Public Works Department.

2,678. He knew of no reason why, if the rates of a contractor were reasonable and he was thoroughly reliable and had put forward the lowest tender, a particular contract ought not to be given to him. It was, as a matter of fact, the general practice of the Department to accept the lowest tender. Hence he could not agree with the contention put forward by another witness that the Department did not accept the lowest tender in cases where the firms who had tendered happened to be thoroughly reliable.

2,679. He was unable to agree also with the statement that the Public Works Department insisted on contractors using only government bricks, and cited the case of the jail at Insein, a particularly large work, where the contractor engaged was allowed to supply his own bricks. In his opinion, it was sufficient to specify in departmental contracts the quality of brick that was to be supplied, and as far as he was aware it had never been stipulated that only government bricks should be utilized in the construction of government buildings. All that the Public Works Department actually insisted on was the use of first-class bricks, but it was generally understood, however, that the only really first-class bricks available in Rangoon were those obtainable from the government brickfield.

2,680. The Public Works Department insisted on their contractors utilizing all stores of British manufacture which had been obtained by indent on the Director General of Stores, e.g., cement. There were no cement works in Burma, and British Portland cement was mainly used both by the Department and private firms. He had had no experience of Indian cement, but had used Green Island and Hongkong cement. In his opinion, private agencies did not use Indian cement to any large extent.

2,681. As he had never been called upon to adjudicate on the rates of a private agency for building work, he did not know the rates of private firms and was not able to state whether private construction was cheaper, dearer or about the same price as that of the Public Works Department.

2,682. Estimates were prepared for annual repairs to each building or group of buildings, and petty repairs, e.g., white-washing, colour-washing, tile-turning, etc., were generally carried out after sanction had been obtained to estimates which were based on standard measurements. He did not think that such preparation involved an undue amount of labour, since the major portion of the time was utilized in taking measurements and not in the actual framing of the estimates. Apart from this the Department was cognisant of the capital cost of each building and knew from actual experience what should be allowed for repairs. Hence after the percentage for repairs on the capital cost of the building had been fixed it was only necessary for the Executive Engineer to prepare a general estimate for all the buildings in his charge by allowing a lump sum on account of repairs to each of the buildings. In his opinion, it was necessary to measure up repair work as many items which were not included in the standard measurement books were usually executed. He illustrated his meaning by remarking that though white-washing might be included amongst the standard measurements the repairs to a window were not, and hence the latter would have to be measured. Measurements had also to be taken as the Accounts Department insisted on their being shown in the bills and the mere fact that a certain allotment had been passed for repairs

in the budget was not sufficient for purposes of audit. Further, it was necessary to keep a record of the items not covered by the standard measurements, as this was the only means of ascertaining what sums were due to contractors. He did not consider it feasible to introduce a system under which the Executive Engineer might be given an allotment for the annual repairs to each particular building, or group of buildings, with full powers as to the manner in which it was spent, so long as a formal receipt was furnished for the amount actually spent as it was conceivable that the entire amount would not always be spent by the contractor. Besides, it was necessary for purposes of audit that expenditure should be supported by details showing how the money was actually spent.

2,683. The majority of measurements in Burma were made by sub-divisional officers, but such officers as a rule were not entrusted with any powers of financial sanction. He was opposed to the grant to sub-divisional officers of powers of technical sanction, even of a small amount, as he did not consider they were suitable agents to receive such delegation.

2,684. Executive Engineers possessed powers of technical sanction up to a limit of Rs. 2,500, but the limit was not suitable inasmuch as a senior Executive Engineer on the verge of promotion to the rank of Superintending Engineer possessed the same powers as the most junior divisional officer. In his opinion, the limit should be increased to Rs. 15,000 for Executive Engineers as a whole.

2,685. Superintending Engineers in Burma could accord technical sanction up to a limit of Rs. 30,000, but the witness was not prepared to state why this limit had been fixed instead of the permissible limit of Rs. 50,000, though, personally, he was in favour of an increase in the powers of these officers to about Rs. 1,00,000.

2,686. The powers of re-appropriation were vested in the local Government and Superintending Engineers, and no limit had been fixed within which a Superintending Engineer could sanction re-appropriations. Once allotments were sanctioned the Superintending Engineer was empowered to transfer funds from one work to another provided the budget grant for the circle as a whole was not exceeded, and the re-appropriation was not from one departmental head to another. The latter and re-appropriation of funds between circles, however, required the sanction of the local Government.

2,687. In his opinion the expenditure from district funds in Burma was not small in comparison with that incurred by the Public Works Department, as the expenditure incurred by certain funds in the delta districts, e.g., Pynou, Moulmein, Henzada, Bassein and Hanthawaddy was equal to about three-quarters of that of the Public Works Department in such districts.

2,688. The Sanitary Engineer to the Government of Burma was as a matter of fact an additional Superintending Engineer. A considerable number of water-works were under construction at present in the province, and these and other sanitary works were generally executed by the Executive Engineer in whose division the work was located, subject to the supervision of the Sanitary Engineer. The reason for this was that the Sanitary Engineer had not been provided with an executive staff and that he had only a small technical staff for the sinking and boring of wells. One of the disadvantages of the system was that in the erection of sanitary works the Executive Engineer had to serve two masters, viz., the Superintending Engineer of the circle and the Sanitary Engineer, but in spite of this drawback the system had worked satisfactorily.

2,689. The construction of water-works was generally given out to petty contractors. There were two large sanitary engineering firms in Burma and both were located in Rangoon, but these firms only undertook plumbing work and did not tender for the construction of water-works such as reservoirs.

2,690. There were certain private firms in Rangoon which undertook entire projects for government electrical installations.

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2,691. The Government Architect was responsible for the preparation of designs for buildings and had no executive functions, though he sometimes inspected the construction of the buildings designed by him. Government buildings were usually constructed by petty-contract subject to departmental supervision.

2,692. Rangoon was at present the only large building centre in Burma. This city was ordinarily divided into two Public Works Department executive divisions, but owing to the war it had been necessary to combine the two. This combined division was a purely buildings division, and did not carry out road or other work. He was opposed to its being placed under the executive control of the Government Architect as he considered that that officer would not have the time to attend to the division's executive work as well as to his own designing and supervising work, and he anticipated that the Architect would find it necessary to utilize the staff of an engineer for the executive work. To furnish the Architect with a separate and special staff for construction would introduce a difficult problem as there would be no openings for the members of such a staff, owing to its smallness, unless they formed an integral part of the general provincial staff and were made interchangeable with the latter. There would be no objection to recognising the Rangoon Division as a purely buildings division under the control of the Consulting Architect and to furnishing that officer with a staff consisting of clerks of works, but it was not possible to create such a specialized division without affecting the interests of the subordinates, whose number would be reduced to the minimum necessary and thus allow for no leave reserve on the occurrence of vacancies. He anticipated that the Public Works Department would probably constitute buildings divisions in other centres, after the war, but he could not foresee whether their formation would not lead to duplication of staff.

2,693. The present Sanitary Engineer to the Government of Burma was an officer of the regular Public Works Department cadre, and he did not think that recruitment for this particular post from the Public Works Department was an unsatisfactory arrangement though it was open to improvement. The three specialist posts of Sanitary Engineer, Electric Inspector and Architect could be recruited from specialists in those particular subjects, but since the Department in Burma had not had the specialist appointments for many years, he was unable to state definitely the terms on which specialist officers should be recruited in the future. He thought, however, that the posts might be included in the regular cadre and that they might carry the same rates of pay.

2,694 (*Sir Noel Kershaw*.) He did not think it was possible, in order to obviate the need for measuring up repair work and to meet the requirements of audit, for the Executive Engineer to submit to the Accountant-General a statement certifying that certain repair work had been executed and to support such a statement by attaching the contractors' bills, as petty contractors in Burma were generally incapable of preparing bills and maintained no system of accounts. He had never heard of a contractor claiming double payment for a work.

2,695. He did not think a comparison of the percentage charges for establishment in Burma with those of other provinces in India was worth undertaking, as there were special conditions in Burma which were not met with in provinces in India. In view of these special conditions he did not consider the establishment charges of 25 to 28 per cent. excessive.

2,696. It might be desirable for the Public Works Department to undertake a comparison of their establishment charges with those of private enterprise, but he did not see that it would serve any useful purpose if, when dealing with tenders for works, the Department knew the rates charged to a private owner for establishment.

2,697. With reference to his remark that two large contracting firms in Rangoon had never tendered for government work, he stated that he did not know the

actual reasons for their action in the matter, but he was personally convinced that the firms were in reality, unable to compete with those who had tendered. In other words, he was satisfied that the firms had not tendered because they knew they would not succeed.

2,698. As many years had elapsed since he had held divisional charge he was not quite sure whether it was definitely stated in a specification that government bricks should be utilized by the contractor, but it was an understood thing that if it were possible to obtain first-class bricks in Rangoon equal in quality to the government bricks, government would stop manufacturing them. It had become the practice for contractors who undertook government work to utilize government bricks, as the quality of private bricks was inferior.

2,699. Government bricks were sold to contractors at about Rs. 21 per thousand at present, but this rate depended on the cost of outturn and varied considerably. Bricks sold to the public were under Code rules debited with an additional 10 per cent. to cover charges for storage, but such percentage was not levied when bricks were issued to contractors for government work. The Public Works Department maintained a profit and loss account of its brickfield, and the account included charges for the purchase of land, coal, stores, headquarter-superintendence, etc.

2,700. During his period of office about 6 or 7 per cent. of the Assistant Engineers under him had not reached administrative rank, and some had failed even to reach executive rank on account of their failure to pass the language examination within the prescribed period. Since he had been Chief Engineer there had been three or four cases in which Executive Engineers had failed to attain the rank of Superintending Engineer owing to their unsuitability. Though it was recognized that promotions to the rank of Superintending Engineer ought to be regulated by merit, the question of seniority largely influenced those in authority in actual practice, with the result that a brilliant officer could not aspire to superseding those senior to him. The personal element was mainly responsible for this position, and superseded men generally memorialized. He had thus to justify his action in sanctioning supersessions. He admitted, however, that his view, especially if it were supported by that of the Superintending Engineer in charge of the circle concerned, usually prevailed with government, and remarked that he personally was in favour of promotion by merit since promotion by seniority was prejudicial to the interests of the service generally.

2,701. (*Mr. Mackenzie*.) With regard to the purchase of stores he stated that, though the rules permitted the local purchase of articles which were already in India, at the time of ordering them, provided that their prices and quality were not unfavourable, such permission was only availed of in urgent cases because the preamble to the particular rule on the subject stated that all stores should as a rule be obtained from the Director General of Stores. He thought it expedient that the Public Works Department should be allowed greater latitude in the matter of the purchase of materials from firms approved by the Government of India, as the present restrictions for the local purchase of stores were not conducive to either efficiency or economy. The tendency in Burma was to restrict indents as far as possible and to effect local purchases of locally manufactured articles with due regard to economy and the saving of time.

2,702. He had used steel manufactured by a certain firm in India but owing to the war that firm had not been able to meet the requirements of the Department. The outturn of the firm was confined to rolled steel beams of the smaller sizes and it had not been able to supply 18" beams to the Department. The cement manufactured in Bombay was not imported into Burma, but the Public Works Department would possibly be willing to try it if the manufacturers established an agency in Rangoon. The Irrigation Branch of the Department had, he thought, given Katni cement a trial. There was no reason why the manufacture of cement should

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not be possible in Burma as water power could be used in the absence of coal.

2,703. Considerable delays were experienced in obtaining stores from the India Office.

2,704. The temporary engineer attached to the Central Stores at Rangoon supervised all departmental indents including those forwarded to the Secretary of State, and every attempt was made to procure either locally or in India such locally-manufactured articles as were required by Executive Engineers. He considered the suggestion for the appointment of a local buyer good in principle, but doubted whether such an officer could ever compete with the Director General of Stores who received indents from the whole of India. In his opinion the present method was cheaper than that of having a separate buyer for each province. Except for delays which had been experienced, the Public Works Department had no complaint to make either in respect to the price or quality of stores obtained through the India Office, especially as it was empowered to purchase articles locally in cases of urgency. The Department was quite prepared to utilize indigenous articles available in India and Burma.

2,705. All imported European stores were tested in England prior to their despatch, as Burma did not possess a testing laboratory. Stores obtained from India were tested by a government inspector in India.

2,706. In regard to the remarks in his written evidence regarding the standards of education imparted in Indian and English engineering colleges, he was not prepared to state that Indian colleges were inferior to those in England and that the average college was invariably good, but he considered the education received by English students before they entered college superior to that of Indian students. He did not think the B.As., who alone were admitted to a certain Indian college, had received the standard of pre-education which he had in mind. Nor did he agree with the contention that the Indian colleges were as good as the English and remarked that it was invidious to draw such comparisons particularly when individuals were only acquainted with their own colleges.

2,707. He agreed that the rule "if the Executive Engineer takes exception to the Deputy Commissioner's views on any matter regarding works in the district, he may refer it to the Superintending Engineer for orders" should not be interpreted so as to leave a reference to the Superintending Engineer optional to Executive Engineers, and explained that such references were made in cases where the Deputy Commissioner insisted on a particular course of action, when a conclusion was generally arrived at between the Superintending Engineer and the Commissioner.

2,708. (*Mr. Cobb.*) The amount of stock in the Stores Depot in Rangoon was regulated by the purchases effected during the preceding five years. The average annual value of the stock taken into the Depot was between Rs. 3 to Rs. 4 lakhs as compared with about Rs. 5 lakhs, the total value of the stock maintained for the whole province. The latter comprised the value of the stores on hand *plus* the value of the annual indents.

2,709. It was premature to form an opinion as to the kind of subordinates Burmans would make, but he had great hopes of them. There were no hereditary trades castes in Burma hence no men belonging to the *mistri* class were employed. He did not think that

Burmans had the same abhorrence to manual labour as Indians as the Burman subordinate was drawn chiefly from the agricultural classes. The students who at present entered the Insein Engineering School usually had but a small knowledge of English and this pointed to the desirability of their receiving a better general education before admission to the institution. They entered the school at present at the age of 18, and he thought it would meet the difficulty if they were accorded preparatory instruction in English and other educational subjects from about the age of 12. Burmans had in the past been very diffident to enter the school and an Assistant Engineer had been placed in charge as headmaster, with a view to increasing the number of admissions. This officer had toured round the province and in different villages and explained the details of the course and the number of appointments given annually and had been very successful in persuading Burmans to join the school. The witness advocated the augmentation of the school staff in order to provide for leave vacancies, and was not in favour of the opening of the school to Indians until the number of Burmans required in the Department had been secured. The affiliation of the school to the University would give it a better status.

2,710. He explained that if the Government Architect were placed in charge of a separate division in Rangoon, the difficulty in supplying that officer with a self-contained subordinate staff lay in the fact that no prospects could be held out to subordinates employed in the division. For instance, if there were four posts held by A, B, C, and D there would be no chance of A going to a better appointment in the province and B being promoted to A's place, whereas if the staff were included in the provincial cadre B would have access to A's appointment since there would be several such appointments. Another difficulty which he anticipated, but which was not insurmountable, was that the Architect might insist on retaining the services of certain men in the division after he had trained them and not permit them to better themselves.

2,711. He approved of the arrangement whereby the Chief Engineer was also the Secretary to the local Government, and remarked that it was very necessary that the head of a department should be in touch with government. Apart from engineering matters, there were several questions that required consideration by the Chief Engineer, and he personally had not experienced any difficulty from the fact that he had acted in a dual capacity.

2,712. The municipal and port trust rates were the same as those of the Public Works Department, but he did not think municipal work was as economical, not because the establishment charges were higher, but because the supervision was not adequate.

2,713. (*Mr. Samuelson.*) When he was an Executive Engineer he usually gave a single contractor an entire project whenever he found one capable of undertaking an entire work, but this depended on his knowledge of the contractors, and as often as not it had been necessary to split up contracts. To give out entire projects to single contractors was an easier system to work, but in the absence of competition the system of splitting up contracts was a cheaper one. From the number of contracts that were given out to small contractors, he surmised that the Department preferred to utilize this class rather than large contractors.

H. E. W. MARTINDALE, Esq., M.B.S.I., Chief Engineer

Written Statement,

2,714. (I.) Economy and suitability of methods of execution of public works.—I am of opinion that the present methods of executing civil works are the most suitable to Burma in the present state of private enterprise and also owing to the scattered nature of the works, the lack of materials and the paucity of skilled labour. More economy and speeding-up would result from giving Executive Engineers greater freedom and reducing to a

and Joint Secretary to the Government of Burma.

minimum the office work demanded from them. The inelastic rules of the Civil Accounts and Public Works Department Codes and the constant references on trivial points wastes valuable time much better spent on inspection and supervision than at a desk.

2,715. (II.) Encouragement of other agency.—Outside Rangoon there are no existing agencies to which either the construction or upkeep of roads and buildings could be entrusted. I doubt if any firm would care to

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maintain district roads. If they undertook such work, they would need a similar staff to that employed by the Public Works Department. It would be inferior in training and trustworthiness and the contracting firm would need a large margin of profit to protect itself from the delinquencies of its own staff and pay the interest on money invested. Any apparent saving in establishment by government would be more than counterbalanced by the inferior quality of work and the steady raising of rates which would result from the disappearance of the possibility of doing work by departmental agency. Much time and money would be lost in legal expenses, etc., contesting contractors' claims or trying to enforce contracts in civil courts. I doubt if it is at all realized to what a great extent the officers of the Public Works Department in Burma are their own contractors, working without middlemen and dealing direct with labour and petty producers of building materials.

2,716. (IV.) Relations with other departments and sub-branches.—The relations with other departments are as a rule cordial and satisfactory in Burma.

2,717. (V.) Decentralization.—Further decentralization is possible if Superintending Engineers are done away with and more freedom and power given to Executive Engineers. I attach a proposal for Burma *infra*, but would point out that the Secretary must be an engineer and not a member of the Indian Civil Service; the tendency for members of that service to secure all well-paid posts is notorious.

2,718. (VI.) Simplification of procedure.—The Public Works Department Code should be simplified and more power given to Executive Engineers, i.e., select and trust your men. Seniority should be done away with unless all else is equal.

2,719. (VII.) Education.—The system of education in government colleges is sufficiently broad to compare with all but the highest in England. I have had under me many young engineers, sent out by the Secretary of State for India, and can say from personal knowledge that the qualifications of the men sent out have steadily deteriorated and some of those last joined have had a much poorer knowledge of engineering and mathematics than Indian college men. It would be easy for the Indian government to raise to any desired extent the training in Indian colleges. The chief defects in the provincial service class is want of breeding and knowledge of English. No improvement can be expected without better prospects. So long as the policy of the Government of India is to treat Indian-trained men as inferior, will private firms adopt the same attitude. The early Roorkee men, whether military or civil, held their own against all competitors, *vide* Wilcocks, Garstin, Ganga Ram, Bagley, James, etc.

2,720. (VIII.) Practical training.—I do not think adequate provision is made nor that even what is available is fully utilized by Indian students. I consider that every student should pay a premium and after six months be given a small salary. What is obtained for nothing is lightly valued and Executive Engineers would have no control over unpaid students. Some portion of the premia, not less than 50%, should be given the Executive Engineer who has to train the men.

2,721. (General.) I append below a copy of my note to the local Government on Government of India, Public Works Department letter No 355-E.A., dated 16th November 1916.

"I have read with much interest the proposals, for encouraging private engineering enterprise and attracting better class Indians to the profession, made in Government of India letter No. 12, of the 2nd June 1916. The reasons for the changes desired and the means for attaining them are to be found in paragraphs 7 to 11.

(2). It appears to me that the real reason why better class Indians do not enter our engineering colleges and difficulty is found in obtaining suitable men for the imperial branch of the service is that sufficient emoluments and status are not given to men devoting their lives to the engineering and allied professions. I have had under me, during the past 10 years, several men recruited by the Secretary of State and have noticed the great

deterioration in attainments of those more recently recruited, so much so that it is frequently stated by Executive Engineers that the men trained in Indian colleges start with better professional knowledge than those sent out from England though socially they are inferior.

(3). I suggest that the true remedy for the ills of the Public Works Department and other departments is to bring their pay and prospects into line with that of the Indian Civil Service. The Indian Civil Service examination could be broadened so as to include subjects that would enable doctors, engineers, architects, etc., to compete. All the men would belong to one service but do work suited to their talents. The Provincial and Subordinate Civil Service would be reconstituted on similar lines. Is it likely that better class Indians will compete for Public Works Department subordinate posts when they can, with less mental effort, become (using Burmese terms) a *myook* on two or three times the pay and with a vastly higher social position? This applies still more strongly in Burma where position looms so largely before Burmese eyes; so long as an advocate is considered to have a more honourable status than a man engaged in mechanical work will better class Asiatics gravitate to law and kindred vocations. The subordinate position accorded by the Government of India to the engineering profession is clearly indicated by the plums (Member of His Excellency the Viceroy's Council) for the Railway Board and Public Works Department being given to the Indian Civil Service.

(4). By making the above suggestion I am advocating no new thing, i.e.—

(a). In the British Navy, after much controversy, all officers receive the same training and those who finally elect to be engineers are higher paid.

(b). In the British Army doctors and engineers rank with combatant officers but are more highly paid.

(c). In France the engineers of the *Ponts et Chaussées* are the best paid officials. They are selected for high administrative posts, i.e., Prefect, Minister of Public Works, Minister of Finance, *vide* M. F. I. Carnot who was finally elected President of the Republic.

(5). Private engineers and large firms of contractors, after nearly three-quarters of a century of British rule, are confined to the presidency and large towns or to large railway enterprises. There are also district board and municipal engineers. The private firms depend largely on agencies for imported materials and plant or the manufacture of structural steel-work and the like. The rigid Code rules for purchasing all materials for public works in England prevent the expansion of these firms and stifle the development of the production of building materials in the country. No improvement in educational facilities can afford relief unless these rigid rules are also relaxed. Better class Indians will not be attracted unless large fortunes, as at home, can be made in engineering enterprise.

(6). While I readily admit that a great deal of the petty work carried out by Public Works Department officers could be entrusted to district board and municipal engineers, merely effecting this transfer will not improve the class of men employed by these local authorities. Nor do I see how making qualifications higher and giving more work can attract better men without offering more alluring prospects. It should be remembered that the best return for high salaries is good work. Work done on repairs and petty work does not call for much skill but they cost in the aggregate a very great deal of money. Saving in staff may be dearly balanced by poor or bad work. Engineering works afford more than ordinary opportunities for graft. Visiting inspectors would not be able to prevent this. The experience of local bodies in England in this respect should induce caution about introducing such agencies in the East.

(7). Delays in getting work done. These are chiefly due to red tape and inelastic Code rules. The Indian Accounts Branch with its formidable Code is master of the situation. Instead of the Accounts Branch adjusting its rules to suit the needs of the spending departments the latter have to mould their procedure to suit inelastic

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Codes framed originally to suit revenue accounting and having little connection with efficient methods of doing work. Both the Civil Accounts and Public Works Department Codes should be revised and simplified or spending departments relieved entirely from the Civil Accounts rules and simple Codes framed for them, suitable to their requirements. I regret that the Government of India letter makes no mention of this disability.

(8). Government of India draft resolution, dated November 1916.

Paragraph (i)—The methods can certainly be improved by modifying the Civil Accounts and Public Works Department Codes and giving greater freedom to executive officers, i.e., select and trust your men.

Paragraph (ii)—So long as the Public Works Department obtains the bulk of its materials and plant through the India Office, private enterprise cannot be encouraged. Petty work and repairs could certainly be entrusted to district board and municipal engineers.

Paragraph (iii)—The system of education in Indian government colleges is equal to that given in most

similar institutions in England. If a better class of man is required better prospects must be offered them.

Paragraph (iv)—A fair proportion, 25 to 33 per cent., of the recruitment to the imperial service should be given to Indian colleges. An honours degree with higher qualifications could easily be arranged, bringing the Indian up to any average desired.

Paragraph (v)—The relations on the whole are good but much red tape might with advantage be done away with.

Paragraph (vi)—No improvement is possible, though it is desirable, without granting higher pay and status.

Paragraph (vii)—Further decentralization is not advisable unless Superintending Engineers are abolished. I give separately a proposal for Burma (paragraph 9).

Paragraph (viii)—The Codes should be simplified.

Paragraph (ix)—All possible encouragement should be given Indians to obtain practical experience on public works, but they should be required to pay premia and draw small pay after, say, six months. What is given free is not valued and it would be difficult to control a host of free lances."

9. Scheme for further decentralization of the Public Works Department in Burma.

	Present scale and pay.		Proposed scale and pay.	
	Rs.	Rs.	Rs.	Rs.
Chief Engineers	2 at 2,750 =	5,500	1 at 3,500 =	3,500
3 Deputy Chief Engineers	Nil.		3 at 2,750 =	8,250
Superintending Engineers	7 at 1,750 =	12,250	Nil.	
Under Secretaries	2 at 1,250 =	2,500	Nil.	
Total administrative		20,250		11,750
Executive Engineers.	37 at $\frac{800+1,250}{2}$	37,025	37 at $\frac{800+1,500}{2}$	=42,550
Executive Engineers selected	Nil.		10 at 250 =	2,500
TOTAL COST		58,175		56,800

In addition, the whole of the cost of 7 Superintending Engineers' offices would be saved with the exception of a few draughtsmen transferred to the Secretariat. Executive Engineers would be divided into three classes as

regards powers, i.e., junior Rs. 800 to Rs. 1,100, senior Rs. 1,100 to Rs. 1,500; selected Rs. 1,500 to Rs. 1,750. They would correspond direct with the Deputy Chiefs and much time be saved.

MR. H. E. W. MARTINDALL called and examined.

2,722. (President.) The witness stated that he had received his training in the Sibpur college, that his substantive appointment was Superintending Engineer, 2nd Grade, that he was Chief Engineer of the Irrigation Branch, and that he had had 27½ years' service; 15 months in addition had been spent as a student on practical training in Chota Nagpur.

2,723. His experience was unique in that his service as an Assistant Engineer had been spent entirely in the Buildings and Roads Branch, while as an Executive Engineer he had been attached only to the Irrigation Branch and had practically severed all connection with buildings and roads work.

2,724. He was of opinion that no agencies existed outside Rangoon to which the construction or upkeep of buildings and roads could be entrusted. Similar conditions applied in the case of irrigation works, and the only one contractor who had been engaged for such work had proved a failure. Irrigation work was carried out by petty-contract and departmentally. Work done by the latter agency amounted to not more than 10 per cent., as the branch avoided the collection of materials and labour wherever possible.

2,725. A great deal of the work done at present could be entrusted to a less qualified staff provided honesty could be secured, as its execution did not necessitate

the employment of a highly qualified staff, but he was unable to suggest a remedy. The main consideration in the matter was to secure honesty and it was for this purpose that government must continue to employ highly qualified engineers, although they were really not required for the class of work undertaken. A large sum of money was spent on repairs and the chances of its being whittled away were enormous. The recruitment of men of lesser qualifications for the execution of unimportant work would result in a saving in establishment but in a loss in the standard of work.

2,726. With the exception of the municipalities, there were no local bodies in Burma other than town committees. These latter possessed smaller powers than the municipalities, and there were no district boards. He had had no experience of the system formerly in vogue under which district fund works had been carried out by a special staff under the Deputy Commissioner. He believed that the system had been in force in Lower Burma in which he had, however, not served. He was not in a position to criticise the work of municipalities. Work was done satisfactorily in cases where the Deputy Commissioner took an interest in its execution, but he considered that the experience of local bodies in England should induce caution in connection with the introduction of such agencies in the East. He here cited the case of

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one such body in England, the guardians of which had been prosecuted in respect to the misappropriation of money, and added that he had received two years' special training on works in England where he had obtained the opinion of responsible engineers in this connection.

2,727. For economy and expedition in work he suggested the abolition of Superintending Engineers and their substitution by Deputy Chief Engineers, as he thought the former were an unnecessary link in the chain of procedure. This would admit of the submission for sanction direct to the Chief Engineer of estimates, and result in a saving of about Rs. 1½ lakhs a year on office establishment. He added that his proposal would not be equally met by the delegation of larger powers to Superintending Engineers.

2,728. In his opinion the accounts were capable of simplification by an accounts officer specially deputed for the purpose, but the question was a large one upon which he preferred not to embark by reason of his limited knowledge of the subject. He had not seen the Decentralization Commission's report in which specific recommendations had been made with regard to the accounts rules in the Code.

2,729. Private enterprise was not encouraged by the present system of indent on the Director General of Stores for materials. Such materials were obtained at cheaper rates from England than by direct purchase in India. He thought private enterprise could be encouraged in India by government lowering the standard of materials in cases where a high standard was not essential.

2,730. He had had experience of the practical training of students both in England and in India, and was in favour of the accord to Indians of greater facilities for gaining practical experience on public works, either free of charge or on the payment of premia. In the former case, some form of disciplinary control would be necessary in the matter of punishments and dismissals, but such control would necessarily be ineffectual by reason of the fact that no guaranteed appointments would be open to the students. A greater hold could be exercised over students who had paid premia as they probably could not afford to lose the money paid for their training. He was in favour of the payment to Executive Engineers of honoraria for the practical training of students, as he considered their training was not part of an executive officer's legitimate duties. It was true that Executive Engineers were whole-time servants of government, but there were limitations to their work and it was inadvisable to burden them with additional work without any com-

pensation. An ordinary Assistant Commissioner was granted a special allowance when engaged on settlement work, as such work was treated as special duty, and he saw no reason why an officer engaged on the training of students should not be similarly treated and recompensed for his labour.

2,731. The expanding needs of India afforded great future possibilities for the cultivation of engineering talent.

2,732. (Mr. Cobb.) The men formerly trained in the engineering school in Insein had proved unsatisfactory, but there had been a marked improvement since the appointment of the present headmaster.

2,733. If contracting firms undertook the maintenance of district roads, they would require a similar staff to that employed by the Public Works Department, but such staff would be inferior in training and trustworthiness and the contracting firm would need a large margin of profit to protect itself from the delinquencies of its staff and it would suffer more in this respect than the Public Works Department. This was one of the reasons why he was opposed to the freer employment of contractors. No work was executed in Burma without the grant of advances and even then the men employed by the contractor sometimes failed him and put him to loss, with the result that contractors protected themselves by charging higher rates.

2,734. One of the cases in which a high standard of materials were not essential was the supply of steel for minor buildings which were not subjected to any great strain, and a cheaper quality of materials was procurable for such buildings from private firms.

2,735. (Sir Noel Kershaw.) He explained that under his scheme one Chief Engineer, instead of two, would only be necessary and that that officer would be assisted by three Deputy Chief Engineers, the bulk of the work resulting from the abolition of Superintending Engineers being transferred to junior officers. Executive Engineers could be given a freer hand as they were quite capable of assuming larger responsibilities, but their powers should be regulated as suggested in his written evidence. From his four years' experience as a Superintending Engineer he considered that half the inspections at present made by officers of the Department were an unnecessary waste of time.

2,736. (Mr. Samuelson.) He considered that the introduction of Deputy Chief Engineers, who would act more or less on behalf of the Chief Engineer, would save a great deal of time and unnecessary correspondence.

J. M'F. PETERS, ESQ., M.R.S.I., M.I.C.E., M.C.I., F.R.O.S., F.Z.S., Sanitary Engineer to the Government of Burma.

Written Statement.

2,737. Out of 25 years' service in the Public Works Department, I have spent 1½ years in the United Provinces, 12 years in the frontier districts of Bhamo and Myitkyina, 2 years in Mandalay and 9½ years in Rangoon.

2,738. (I.) Economy and suitability of methods of execution of public works, and (II.) Encouragement of other agency.—Most of the work I have carried out has been done through the agency of native petty contractors. During the 14 years I spent in Upper Burma, I have never come across a contractor who had the requisite amount of engineering or technical knowledge to carry out the work entrusted to him, without careful and constant supervision from the Public Works Department staff. I am convinced that it would not be to the interests of government if the supervision now exercised, were relaxed in any way, by abolishing or reducing the existing Public Works Department establishment of the Buildings and Roads Branch and substituting private agency, as foreshadowed in the Government of India resolution.

(2.) During the 10 years I have been in Rangoon I have had experience of building contractors both good and bad. The General Hospital and Chief Court, Rangoon, involving an expenditure of Rs. 60 lakhs, were built by

me while I was Executive Engineer of the Rangoon Construction Division. I am of opinion that it would not be to the interests of government, even in large highly concentrated works like these, to reduce the Public Works Department executive supervising staff to any extent.

(3.) In any large work government engineers must be on the spot every day to see that work is carried out according to specifications and drawings. Much work gets covered up during construction and cannot be inspected again and there are many opportunities for dishonest men. Moreover, during the course of construction, modifications have frequently to be introduced, for which there must be proper authority.

(4.) In the present state of Burma I do not see how it will be possible to carry out the steadily increasing number of public works in this country chiefly by private enterprise, as the supply will not meet the demand for generations to come. In my opinion the Public Works Department staff of Burma is already too small as it is, for the area that has to be covered and the poor state of its internal communications. Outside of Rangoon only native petty contractors are available and it is most difficult to get reliable and suitable men. Most of them start as petty traders with practically no capital and at the best are only capable of collecting labour and certain

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local materials like bricks, stone, timber, lime, sand, road metal, etc.

(5). The Public Works Department would hail with joy the advent of contractors with engineering qualifications and the necessary capital, but it is certain that none of these would be willing to take up work in the wilds, where pioneering conditions prevail, unless rates were far higher than what the Public Works Department pay at present.

(6). There are thousands of small works in out-of-the-way places where no engineering firm would be able to compete with the small native contractor. With slack supervision or collusion on these works the profits would be large and the only way for government to get value for money expended is, in my opinion, strict supervision by officers, sufficiently highly paid to be beyond the reach of contractors.

(7). I think the present moment most opportune for putting to a practical test the question of whether it is possible for the Government of India to do without the greater part of the *personnel* of the Public Works Department in the Buildings and Roads Branch. I understand from a perusal of Government of India, Resolution No. 06-E.A., dated 21st November 1916, that this is really at the root of the present inquiry.

(8). Owing to restriction of budget grants, works have necessarily been very much curtailed in every province. A large proportion of the Public Works Department have applied to be allowed to volunteer for active service where engineers are badly wanted. Very few have however been allowed to go. Would it not be a simple matter to let most of them go and to retain just the few inspecting officers that the Government of India consider necessary? Much harm could not come of this experiment, because original works have been practically shut down. All the public works of the province could then be run by contract by local bodies, under the district authorities, who would have an opportunity of proving that most laymen are born engineers! During my experience in Burma, I have been seriously assured by the members of a distinguished service that they could carry out all public works just as efficiently and far more economically!

(9). Ninety-five per cent. of Public Works Department work in Burma is done by contract. Work is not carried out by departmental agency to any extent, as far as I am aware. When this is done, it is from necessity and not from choice and is only resorted to either when private enterprise is lacking, or when contractors think they can force high rates from government owing to lack of competition. I have had some experience in this and have frequently saved government large sums of money by doing the work departmentally and proving to contractors that their rates were too high.

2,739. (V.) Decentralization.—In my opinion Public Works Department work would be carried out more rapidly, efficiently and economically if the Executive Engineer were less trammelled with red tape. The Public Works Department Code ties him to such an extent that he is deprived of much initiative. The aim of this respected publication is to render the Department more or less fool-proof.

2,740. (VI.) Simplification of procedure.—The Audit Department has increased executive office work and has taken up an attitude of destructive criticism with reference to Public Works Department accounts. Since the amalgamation of the Civil with the Public Works Department accounts, circular after circular has been issued from the Accounts Branch, the effect of which has been to reduce the labour in audit, generally at the expense of a corresponding increase of responsibility and clerical work in executive offices. A notorious example of this is the monthly establishment salary bills. This amalgamation has reduced the efficiency of Public Works Department audit that originally obtained and this will be proved later on, when some big defalcation takes place and only comes to light when it is too late to remedy matters. It will then be found that the audit will be in a position to throw the responsibility of the loss on the executive. The present

system of audit could be carried out just as efficiently by private chartered accountants, at a tenth of the cost.

2,741. (VII.) Education.—It seems to have been assumed throughout this reference that the engineering education given at Indian colleges is in some way inferior to that given at home. I do not know how this idea has arisen. If investigated, I am confident it will be found erroneous. A comparison of the engineering examination papers set at the universities at home with those set, say at Roorkee and Sibpur, will convince the inquirer that there is nothing to choose between the standards of education required for the same diplomas. As the practical course is now all done in India, there is really no difference as far as educational qualifications count, at the time of appointment, between the Secretary of State's nomination to the imperial Public Works Department and the man who obtains a guaranteed appointment to the provincial Public Works Department from an Indian college, under very severe competition.

(2). I would go further and say that the latter has probably passed a stiffer engineering examination owing to the competition, yet he gets only two-thirds of the imperial man's salary and carries through life the stigma of belonging to an inferior provincial service, to which deserving subordinates of long standing, but with hardly any college qualifications, are promoted.

(3). Is it any wonder that there is profound discontent, dissatisfaction and disloyalty in the Department? How can men, having the same educational and professional qualifications and doing the same work, pull together and have feelings of esteem and good-will towards one another, if they are treated as "high caste" and "low caste" by government? It is natural that the "imperial" man should look on himself as the salt of the earth and patronize the man appointed to the "provincial" or subordinate promoted service, for there is nothing in the latter to differentiate between the subordinate, promoted very rightly for good and faithful service, and the highly trained college engineer whose professional qualifications, on first appointment, are in no way inferior to the Secretary of State's selection.

(4). It is also natural that the "provincial" college appointed engineer should deeply resent the injustice of being placed in a position which is treated as inferior from every point of view—socially, professionally and financially. After a few years' service, his eyes are opened to this state of affairs, he sees the unbridgeable gulf between the provincial and imperial services, and realizing the enormous difference in social status and loss of monthly salary, he comes to the conclusion that he has been tricked! It would not be surprising if, being treated as an inferior, he turned out inferior work.

(5). This anomaly was created by the Government of India in 1893 in the Public Works and Telegraph Departments—the only branches of the public services in India where men with professional qualifications, equal in all respects to those of "imperial" men, are appointed to the inferior "provincial" service. Until this anomaly is removed, I consider it is expecting too much of human nature to get loyal and efficient service throughout the Department and for the reasons given by me, I consider that this is the most important modification in the reorganization of the Public Works Department staff which should be carried out.

(6). The Public Works Department is not a popular service in India now-a-days, as is apparent from the fact that suitable recruits, notwithstanding vigorous drum-beating at the universities at home, are getting more and more difficult to catch from year to year. Why is this? It is because living in India now is far more strenuous and expensive than 15 years ago and the present pay, prospects, pension and social status of the engineer in the Public Works Department with a varsity training, are much inferior to the Indian civilian whom he has, as often as not, beaten at the University before coming out.

(7). A few years after the Public Works Department engineer arrives in India, he finds that the Indian civilian

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is drawing from 50 to 100 per cent. more salary for the same length of service, and that his status in the country is as nothing compared to his. He also finds that the administrative plums of every department and service, both under the Government of India and the local Governments, are closely preserved for members of the Indian Civil Service, who annex quite 90 per cent. of the higher honours and distinctions given to government officials.

(8). The recommendations of the Royal Commission have been a great disappointment to the Public Works

Department as the present unsatisfactory position of its engineers has not been improved. It is hopeless for the government to expect to get suitable recruits of still higher educational and professional qualifications without first very materially improving the status and prospects of the Department.

2,742. (VIII.) Practical training.—Under the circumstances obtaining in this province, I think that adequate provision is made for the practical training of students on works—both those appointed from English and Indian colleges.

Mr. J. M.F. PETTERS called and examined.

2,743. (President.) The witness stated that he had been Sanitary Engineer to the Government of Burma since March 1915, and that prior to this appointment he had spent the whole of his service in the Buildings and Roads Branch, with the exception of about 1½ years in the Irrigation Branch in India. He possessed special qualifications for his present appointment in that he had devoted a considerable amount of time to the study of sanitary engineering, and had been specially deputed, when on leave, to improve his knowledge of the subject in England, France, Austria and Germany.

2,744. He had been connected with building work in the Rangoon Construction Division for about 9 years and stated that tenders were called for entire works. As instances, he cited the cases of the General Hospital and the Chief Court, Rangoon, which cost Rs. 45 lakhs and Rs. 25 lakhs respectively, for both of which public tenders had been invited. There were probably not more than two European contractors in Rangoon at the time and both of these tendered for the works but were unsuccessful.

2,745. Both works were given to an Indian contractor. This man had practical experience as an engineering contractor but no professional training. He completed the works satisfactorily with the aid of a European master builder, European foreman plumber and a few Indians who probably possessed some qualifications as sub-overseers. He relied entirely on the Department in matters of technical detail.

2,746. The Rangoon Construction Division executed a number of petty works which were open to all contractors who cared to tender, but such works, as a rule, were taken up by Indian contractors who generally underbid European contractors by 25 per cent.

2,747. He was not aware of the proportions of private and government building work in Rangoon, but was of opinion that government work formed an important factor in private enterprise inasmuch as it afforded sufficient work for a number of contractors. He had made a comparison between private and government rates and had found that the Public Works Department rates were lower by 25 to 30 per cent. In the case of a large work in Rangoon, which had only recently been completed by European contractors from Calcutta, he had compared the two rates and found that there were very few cases in which the departmental rates had not been 25 per cent. lower. He could not explain why Indian contractors were prepared to take the Public Works Department works so much cheaper than private work, unless it was because they had to accept the best rates they could obtain in competition. He considered that departmental work was profitable to contractors, but not to the same extent as private work. The smaller contractors did not employ a large establishment, and lived on a modest scale and were content with small profits. They were not master craftsmen generally, but men who had had experience of labour and the economical purchase and use of materials, and did their work without the aid of a highly paid supervising staff.

2,748. The two large buildings he had referred to were constructed with government bricks, the utilization of which had been specified in the tender. The contractor supplied his own lime, but cement was obtained from the government store depôt. Such materials as were not available in India were purchased in England. The contractor had been anxious to obtain English materials

as they were superior in quality and cheaper than those obtainable in India and he had not to pay interest to government on the supply. The bricks supplied by government for the construction of the two buildings were superior in quality to those available in the open market; in fact, there was no comparison between the two. No private firm in Rangoon had, during the past 15 years, manufactured bricks of the same quality as those manufactured by government. He was convinced that there was not a single firm in Rangoon which manufactured bricks equal in quality to those turned out by government. The justification for the supply of bricks by government was not only their better quality but also the fact that they were manufactured cheaper than private bricks. When the construction of the General Hospital and Chief Court was commenced, about 2,000 lakhs of bricks were required, and when this fact was known the private brick manufacturers of Rangoon immediately raised their rates. The Public Works Department therefore purchased their own brickfield, both in order to be independent of the inflation of prices and to ensure a steady supply of bricks for the continuous progress of the work. The case was not an exceptional one, as a rise in prices occurred at the time of the construction of Government House and the Customs House on its becoming known that private bricks were required. It would probably have been possible to obtain private bricks for the construction of the new Telegraph Office in Rangoon, but they would not have been of the same quality as government bricks. Even if a superior quality of bricks were specified in the contract, he did not think they would be manufactured by private brick manufacturers, none of whom were building contractors.

2,749. He had had experience of combinations amongst contractors to force up rates, not only in remote districts in Burma but also in Rangoon. A recent instance of this was the sanitary work (labour) for the new Telegraph Office, Rangoon, where the work was executed departmentally for Rs. 13,000 less than the lowest tender on an estimate of Rs. 35,000. He did not know whether there was much combination in Rangoon in the ordinary building trades.

2,750. The Sanitary Engineer was subordinate to the Chief Engineer and his principal duties were of an advisory nature. Sanitary work was at present in an incipient stage, the chief works undertaken being water-supply, bazaars and drainage schemes in towns. These were designed by him and the work was carried out by the local Executive Engineer subject to his supervision. Local bodies and municipalities were not debited with the entire cost of the preparation of schemes and were only charged 1½ per cent. for accounts. The correct charge would ordinarily be 24½ per cent, but no municipality in Burma could afford to pay these charges with the exception perhaps of Rangoon, Mandalay and Moulmein. He had a special staff for the preparation of sanitary projects, but had only a small staff for supervisory work. He inspected sanitary works under construction by Executive Engineers to ensure that they were carried out according to his ideas, and was required to issue his instructions through the Superintending Engineer to whom the Executive Engineer concerned was subordinate. By dealing direct with the latter officer and asking him to keep the Superintending Engineer informed, works were carried out without friction and with greater expedition. He was not merely an inspecting

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officer, but had also executive functions, e.g., all tube wells in Burma were sunk by the special staff of the Sanitary Engineer; to ensure the correct laying of pipes the plumbing staff of the Sanitary Engineer was freely indented upon by Executive Engineers for the water-supply distribution schemes of towns; sanitation schemes for buildings were prepared in the Sanitary Engineer's office and frequently executed by his staff. The system in Burma had been found satisfactory and he was not in favour of the formation of a separate Sanitary Branch directly under his orders, as it would not be necessary for some years to come. He was, however, of opinion that such a branch would eventually be found necessary, and that it would then perhaps prove economical.

2,751. Executive Engineers called for tenders and made the best arrangements that were possible for the execution of drainage and water-works. If large contractors were available the work was given to them, but owing to the dearth of such contractors work had to be given out to petty contractors. There were no sanitary engineering firms in Burma with experience of large water and sanitary works, but there were firms who could do plumbing work. Most contractors could carry out a drainage scheme as it only involved the making of drains. The system followed by the Sanitary Engineer of Bengal of entrusting complete sanitary schemes to recognised sanitary engineering firms was not practicable, as there were no firms of such standing in Burma. It would not pay a firm to set up in the province because of the insufficiency of sanitary work.

2,752. The annual sanitary grant in Burma during the past two or three years had been Rs. 6 lakhs. This embraced the expenditure on bazaars, drainage and water-works.

2,753. He had no change to recommend in connection with the organization of the Sanitary Branch in Burma. This was satisfactory and met the present needs of the province and would do so for probably the next ten years. With the present rate of development in the province, he believed that a specialist in sanitary engineering would not be necessary for many years to come. He considered that the duties of the Sanitary Engineer could be efficiently and satisfactorily performed by any experienced Public Works Department engineer who took a keen interest in this branch of engineering, just as the duties of the Sanitary Commissioner were satisfactorily performed by a doctor who was an experienced officer of the Indian Medical Service. When the province developed more, it would be an advantage to appoint an officer with special sanitary qualifications. At present this was really not necessary.

2,754. In his opinion the amalgamation of the civil with public works accounts had increased rather than diminished the Executive Engineer's work, and he supported his view by giving one instance. The monthly establishment salary bills now-a-days involved much more work than formerly. In fact the trouble and responsibility in connection with the payment of salary was entirely out of proportion with that formerly experienced.

2,755. The monthly accounts had not undergone any appreciable change since the amalgamation. He had had 2½ years' experience of the new system in the Rangoon, Construction Division and had found that it involved increased work and responsibility and that audit was not as efficacious as formerly. From what he could

see the amalgamation had only simplified the work of the audit officer. Very few Executive Engineers understood accounts, probably not one in twenty, as they were full of technicalities. A scrutiny of the objections at present raised in the divisional accounts revealed the fact that nine-tenths of the objections need not have been raised, as most of them were frivolous. The objections were not so numerous under the former system, as officers with a special knowledge of Public Works procedure dealt with the audit of accounts. The amalgamation had a prejudicial effect on the executive work of the Department. He suggested that the present system of audit could be carried out just as efficiently by private chartered accountants at very much less cost. He had a good deal of experience with the auditing of accounts by chartered accountants in connection with the management of clubs and understood the procedure. Such accounts were audited once a year, which corresponded to the system in vogue in the Public Works Department under which the Examiner went through the books annually in the office of the Executive Engineer. The bulk of the monthly audit could be dispensed with as being of no material value. The witness dealt with no accounts in his present capacity.

2,756. (Sir Noel Kershaw.) Contractors generally undertook work for the Public Works Department at 25 to 30 per cent. less than for private people as the latter were not cognisant of the rates. Much depended on whether a private individual employed a small contractor who would be willing to accept a small profit. Ordinarily, a private individual had to pay for the trustworthiness of his contractor.

2,757. An Assistant Engineer and about four or five Indian subordinates supervised the construction of the General Hospital, Rangoon. The Assistant Engineer was a whole-time man. He himself was at the time in charge of all the buildings in the Rangoon Construction Division, and approximately one-half of his time was spent in connection with the construction of the hospital. As far as he could remember, supervision charges and the Architect's fees were not included in the comparison of rates which he had made between government and private work. In his opinion the Architect's fees were not as high as 5 to 25 per cent.

2,758. In constructing the two large buildings he had previously referred to, the contractor had received prompt payments, some of which might have been regarded as advances, but, as a matter of fact, advances were rarely granted to contractors in Rangoon.

2,759. An Architect could not effect as much supervision on the construction of a large work like the General Hospital as an Assistant Engineer or clerk of works with responsible subordinates, because the Architect's position would be analogous to that of the Executive Engineer.

2,760. (Mr. Cobb.) For the construction of a large work similar to that of the General Hospital, European contractors would require larger profits than Indian contractors. One of the reasons for the inability of European contractors to compete with Indian contractors was their much higher standard of living.

2,761. In his desire to push government work he had frequently contravened orders and made advances to contractors in jungle districts outside Rangoon, as labour could not be procured without this facility. Ordinarily the interest on money borrowed by contractors absorbed most of the profits.

B. RAIKES, Esq., Electric Inspector to the Government of Burma.

Written Statement.

2,762. *Standpoint of writer.*—I was trained chiefly as a mechanical engineer and have had eight years' experience with private companies, not including seven years' apprenticeship.

(2). My service with government, after appointment by the Secretary of State, extends to eleven years and my duties in this service are executive and statutory (inspectors) as well as advisory to the local Government.

2,763. *Training of officers.*—Special facility for home

training does not appear to be given at present. Many officers have had practical experience at home before they joined the service, but before joining the service they know little or nothing of the work they are required to do in India and, consequently, spend their time on details of some large project a similar one to which they would be unlikely to have charge of more than once in their service. The business side of the work they will probably not enter into at all.

(2). Home training with suitable firms after about 4 or 5 years' experience in India would afford opportunity

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to officers to get into touch with details which they know would be of value to them, as well as with the business side of the profession as practised elsewhere. The time spent at home should be at least one year of actual training.

2,761. *Training of subordinates.*—During early service the subordinate is in close touch with work in progress, that is to say, standing over it and supervising it. His theoretical training may or may not have been sound, but his knowledge of methods of work is generally picked up from contractors' workmen and is held as good by him till he sees or hears of better methods. To get good work cheaply and quickly done, good methods are essential and the instruction of subordinates by first-class tradesmen brought out specially for short periods (say, two years) to various centres would improve the standard of work all round. Artisans and others in India are, I know, slow to adopt new methods, but I believe that is chiefly because they do not see the direct advantage of them and there are few capable of teaching them right through from beginning to end. The average workman in India is by no means a dull pupil if he understands his teacher and would readily pick up sound methods from subordinates and others supervising him, provided those methods were correctly shown to him.

2,765. *Organization.*—My experience of the general organization of the Public Works Department is somewhat limited but certain defects which I do not think are special from any single point of view and which are, I know, a continual source of wonder, if not annoyance, to private companies and others dealing with the Department might with advantage be remedied. They are:—

(1). The delay in correspondence due to the various channels through which it is required to pass. The remedy for this (which may also be the remedy for other defects) appears to be in the shape of more direct correspondence between the Executive Engineer or engineer in charge of works and the head of the department, with wider powers for the Executive Engineer and more special and direct assistance for the head of the department in each province in all the branches. This practically means a fully equipped central office with its specialists and powers to deal directly with the officer in charge of works and is a scheme which, I understand, has been suggested in detail by others.

(2). The want of a method of distributing the results of tests, trials, designs, etc. Tests and trials are often made in different parts of the province, the results of which are seldom circulated in such a manner as to be useful to those carrying out works with which they have immediate connection. A central office would be useful in this direction.

(3). The occupation of the time of highly paid executive officers in dealing with petty items of returns, accounts, etc. It is not denied that many, if not all, of the forms of accounts, returns, etc., and consequent correspondence are necessary for the correct compilation of accounts and the information of various officials, but although this question has, I understand, frequently received attention, I cannot help remarking that a system which calls for such a large number of forms, each to be signed by an executive officer perhaps in more than one place, appears to have been designed for the express purpose of documentary evidence and that if such evidence is necessary in any one part of a work, which, after all, is made up of many parts, it is surely necessary in others. To carry out a work many things are essential and the amount of attention a person in charge of a work will devote to any one part of it is usually regulated by the importance of that part for the time being, but although discretion is left to an executive officer as to the amount of supervision he should personally undertake on actual works or the details of them, no discretion appears to be allowed him in supervising the many petty details of

returns and accounts, which after all form part of the work and which a trained accountant is as capable of looking after as a sub-divisional officer or subordinate is of his own particular part of the work. A central office would also assist here. I can only deal with the other leading questions from the point of view of an Electrical Engineer to Government.

2,766. *The supply and erection of electrical machinery and material for government use.*—Large works in this province are usually carried out by contract. Smaller works are carried out departmentally with material purchased locally and by tender. There appears to be little scope for improvement in this direction as the leading firms do not, as a rule, care to tender for small works and are content to supply the material.

(2). Obtaining material straight from home for government use appears at first sight to be a more economical method of dealing with petty works and repairs. This has been tried and no particular advantage found, either in price or quality, but the storage of large quantities of perishable material has been found to be a distinct drawback.

(3). The maintenance and running of electrical installations are done by the Department and any other method would, I think, prove unsatisfactory for the following reasons:—

The annual sanctioned amounts for maintenance are, in most cases, small, but they are sufficient to keep the plant in proper repair for an indefinite period, if properly laid out. In order to accomplish this, repairs, no matter how small, have to be undertaken at once on the principle of a "stitch in time." With maintenance in the hands of a company this would be seldom carried out, as inspection of plant about which no complaint had been made, would not, as a rule, appeal to them and inspection by a government servant would not help matters to any great extent as a staff would be required for this purpose.

(1). Complaints and orders are more easily attended to when a staff is provided specially to attend to them.

2,767. *Electrical Branch, Public Works Department.*—Certain inconvenience is now being experienced in this branch of the Public Works Department owing to the lack of uniformity in the appointments to the various provinces, also the differences in the classes of work adopted in them; the latter inconvenience, which is chiefly felt by large contractors, is being remedied to some extent by intercommunication and standardization of specifications, but the former can apparently only be remedied by the adoption of a graded scale of pay and the provision of men suitable for reliefs.

(2). Proposals for grade pay, etc., have, I understand, already been made and I agree with the following in brief outline.

2,768. *Status and Pay.*—(a) Electrical Engineer (or Inspector), 3rd class, on Rs. 700—50—950, with the status of an Executive Engineer.

(b). Electrical Engineer (or Inspector), 2nd class, on Rs. 1,000—50—1,300, with the status of an Executive Engineer.

(c). Electrical Engineer (or Inspector), 1st class, on Rs. 1,350—50—1,600, with the status of a Superintending Engineer.

Officers on appointment may be placed in either the 2nd or 3rd class.

(2). With regard to this proposal for a graded scale of pay which to some may appear exceptional for men who merely "attend to the electric lights in bungalows" or "inspect motors in a dirty corner of a mill," I would like to point out the inconvenience a government might suffer by placing for advice proposals for say the electrification of a mining area, oil field, large hospital or railway system before a man who is not at least capable, through his own training and general experience, of grasping the requirements and giving sound advice as to general principles, if not as to actual detail.

MR. B. RAIKES called and examined.

2,769. (President.) The witness stated that he was the Electric Inspector to the Government of Burma

and that he had had 11 years' service. He had originally received a training in mechanical engineering and had

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[Continued.]

not received a special training in electricity, his knowledge having been acquired in the school of practical experience. He added that he had at one time served with electrical firms in England.

2,770. He was directly subordinate to the Chief Engineer, and worked in conjunction with Superintending and Executive Engineers, as occasion required, but he did not receive orders from the latter officers. His duties were twofold, statutory and advisory, and executive, and the former absorbed a quarter of his time while the latter occupied the remainder. The statutory duties were connected with the administration of the Indian Electricity Act and consisted of the inspection of plant owned by electrical firms and the framing of rules and regulations, e.g., the rules which had been specially drawn up for the working of the oil fields. There had been very few cases of disputes between companies and consumers upon which he had been called upon to arbitrate and there had been no dispute in which government had been a party. Prior to his appointment there had been a case in Mandalay, but it came under the old Act.

2,771. He did not think that there was any fundamental objection to the principle of the Electric Inspector exercising administrative and executive functions provided that officer performed his duties conscientiously.

2,772. In his advisory capacity he dealt with electrical schemes submitted to government, the grant of licenses, and generally all electrical cases, e.g., any large hydro-electric scheme which was before the government, but work of this nature was at present small though there was a likelihood of its expansion. The number of licenses granted under the Indian Electricity Act was not large.

2,773. As an executive officer he had direct charge of the government installations of which there were altogether about 200, 53 large, and the remainder small. The installation in the General Hospital was one of the largest and was self-contained. Its generating plant was 260 horse power. The only other generating station with which he was concerned was that at Government House, Maymyo, and this was a small one. The other installations were in offices and residences and a great deal of his time was absorbed in maintaining them and erecting new installations in such buildings whenever they were required. A skilled engineer was employed for the supervision of these smaller installations because of the tendency to put up inferior work. The standard of work in Burma was, however, fairly good on the whole. He anticipated there would be three large installations in the near future, which would require more highly trained men than ordinary wiremen and fitters.

2,774. His staff consisted of four permanent non-pensionable subordinates on a salary rising up to Rs. 400 a month, and three temporary men. The first of the former was in charge of the power station at the hospital, the second had charge of the other buildings in Rangoon, the third was at present engaged in the war and the fourth in charge of the installations at Mandalay and Maymyo.

2,775. Tenders were called for entire works, that is labour and materials, for the construction of large works, and petty repairs and smaller works were generally executed departmentally to avoid inconvenience to the occupants of buildings. There were only three large electrical firms in Burma which were capable of undertaking work, two in Rangoon and one in Mandalay. There was thus very little competition and on occasions it had been found necessary to advertise in India. The tenders received from India, however, had not been numerous nor had the rates compared favourably with local tenders. For petty construction and repairs he advocated the departmental system.

2,776. Wiremen in Burma were composed of Burmans, Indians and Chinamen. They were not trained for their work but were carpenters or fitters who learnt what was required of them from actual experience. Their work was fairly good.

2,777. He had not had much experience of the stores rules as most of the apparatus and fittings, even for

repairs, was obtained direct from firms and a limited quantity was kept in stock. In some cases it had been found that materials could be had in the open market at rates cheaper than those kept in stock. Hence it was inadvisable to maintain a large stock reserve, especially in the case of perishable articles, e.g., rubber. The materials for house wiring were available in Burma. He advocated the purchase of engines and boilers through firms in the country as they understood the requirements and were quite as capable of supplying good materials as the Director General of Stores. One of the advantages of such a system, in his opinion, was that the agents could always be referred to whenever necessary.

2,778. He suggested the recruitment from England of master workmen and mentioned that his suggestion was not confined to electrical work. A skilled artisan, in his opinion, would be a useful adjunct to the Department and each province could import the class of master workman it most needed. Two master masons would suffice, for a start, for Burma, and one of these could be stationed at Rangoon and the other at Mandalay, master carpenters, master iron-workers, etc., being recruited later. The man stationed at Rangoon could then be attached to the Insein college and give a limited number of subordinates, deputed to the college, a course of practical training for a specified period, and the presence of such a master workman at the Insein school would indirectly benefit the students. Chinamen carpenters were good but there was an absence of finish in their work. In his opinion, the class of such carpenters procurable in Calcutta was in all respects superior to that available in Rangoon and Burma generally.

2,779. In his opinion the best field for the recruitment of electrical engineers was England as the men trained there were usually in touch with large works and acquired a knowledge of the manufacture of various classes of electrical material. The men trained in India, on the other hand, did not possess the same knowledge as they did not have the same opportunities. He himself had been recruited from England, but from his experience of electrical firms in India he felt that though Indian-trained men had the advantage in their knowledge of local conditions those trained in England made better electrical engineers. He therefore recommended that men with English qualifications should be recruited for permanent employment in the Electrical Branch on three years' probation, and that such recruitment should be confined to those who had completed their electrical training and received a substantial amount of practical experience in England. He considered that such men might be recruited at the age of 27, as electrical engineers ordinarily completed their theoretical course at the age of about 24, and this would admit of their having at least three years' practical experience on works which was very essential, and further that a salary of Rs. 700 rising to Rs. 1,600 after 18 years' service, by annual increments of Rs. 50, would prove sufficiently attractive.

2,780. The best method of recruiting men other than electrical engineers proper for the Electrical Branch would be to obtain them from firms in India which afforded sufficient scope for the purpose. He was not in favour of the establishment of a special college for the training of electrical engineers.

2,781. (Mr. Cobb). If and when the occasion arose for the employment of an Assistant he would require a man on Rs. 700 who had received an English training and not a man from one of the local firms, so that he would be able to carry on his (the Electric Inspector's) work during his absence. When he last went on leave a man from a local firm had been appointed in his stead as no junior Electric Inspector was available. He added that the Assistant, if eventually appointed, should be allowed to draw increments during the probationary period and to rank as an Executive Engineer on his confirmation in the Department. The question whether the Assistant's service should be pensionable or otherwise would depend on his age, and if he were fairly advanced in years a provident fund would be suitable.

2,782. He had no objection to the extension of the educational scheme he had proposed to artisans and to

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[Continued.]

the inauguration of evening classes for the purpose if men were forthcoming, but he anticipated that difficulty would be experienced in starting such classes. The stations at which they might be given a trial were Rangoon and Insein.

2,783. (Sir Noel Kershaw.) He admitted that the scheme he had proposed for the recruitment of electrical engineers would lead to considerable expenditure, but he did not have the immediate recruitment of electrical officers in mind. All he pleaded was that each province might be allowed to employ additional officers as the need for them arose. There was no necessity at present for an Electric Assistant in Burma but the need for such a man would be felt when the oil fields were extended. His scheme provided for a leave reserve, and the original scheme, which was a sound one, had been initiated by the Electrical Adviser. The latter was drawn up so as to admit of the employment of a sufficient number of officers for India as a whole, and their transfer to provinces where they were most needed.

2,784. Owing to the lack of uniformity in the classes of work hitherto executed in India and Burma a set of specifications had been drawn up at the last electrical conference for certain descriptions of work.

2,785. Private firms would stock electrical apparatus and fittings to meet the requirements of government, if they were assured of receiving orders from government.

2,786. (President.) Burma possessed no electrical laboratory at present, but the question had been discussed at the electrical conference which came to the conclusion

that it was necessary that all the major provinces should have laboratories of their own. The establishment of a laboratory in Burma was under contemplation, the idea being that government should take over the tramway company's instruments, which were very good ones, and manage the laboratory, allowing the tramway company to do their testing in it. In his opinion, a laboratory would be of great assistance to men undergoing an electrical training.

2,787. He had no official connection with the Electrical Adviser to the Government of India, and only corresponded unofficially with that officer whenever necessary. It was not the practice for the Electrical Adviser to make tours of inspection in the province, but he had been to Burma, before the witness' appointment, in connection with some special municipal and tramway work. The electrical work in Burma was not directly controlled by the Government of India, though formerly, under the old Electricity Act, it was necessary to approach the Government of India in the matter of the grant of certain licenses. There had not been a single appeal to the Government of India under the present Indian Electricity Act.

2,788. (Mr. Samuelson.) The success of the evening classes for the training of subordinates, under a master mason or carpenter, would be dependent on the men being granted leave for two or three weeks to undergo the course of training. The night schools could be started at Insein, which was situated near to Rangoon, but here again success would be dependent on a regular and suitable train service between the two towns.

At Rangoon, Thursday, 8th March 1917.

PRESENT:

F. G. SLX, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

A. T. MACKENZIE, Esq.

C. S. COBB, Esq., M.V.O.

And the following Co-opted Member.

B. M. SAMUELSON, Esq., M.I.C.E., M.R.S.I., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary).

The Hon'ble Mr. H. THOMPSON, C.S.I., I.C.S., Financial Commissioner to the Government of Burma.

Written Statement.

2,789. I must preface my note by stating that my views are based entirely upon Burma experience. I know nothing of the organization of work of the Public Works Department in other provinces.

2,790. (1.) Economy and suitability of methods of execution of public works.—I consider that as regards both buildings and roads the quality of work carried out by the Public Works Department is sufficiently high at present and that it compares not unfavourably with the best work undertaken by private agency. I do not think it necessary, therefore, that any endeavour should be made to raise the standard of quality and I think it important that no changes should be introduced which would be likely to lower this standard to any material extent. In the case of both buildings and roads good work in the first instance means a longer life and less expenditure on repairs. For financial reasons it has been necessary in the past to construct many of the public buildings in Burma either wholly or partly of wood, but these are being gradually replaced by buildings of more permanent material as funds can be made available. The roads of Burma have been a bye-word in the province, but the absence of roads and the bad condition of exist-

ing roads have been due to the lack of funds and to the large variations from year to year in the allotment of such funds as could be made available rather than to any shortcomings of the Public Works Department.

(2.) I am inclined to think that whilst the quality of work is good the cost is unduly high, and that economy might be obtained by improvements in the methods of executing civil works and in the arrangements for financing such works. The bulk of the work is being undertaken at present by petty contractors who work under the immediate supervision of the Public Works subordinate staff and under the general supervision of the higher officers of the Department. The rates tendered for such government contracts are believed to be generally higher than the rates at which the work could be carried out by private employers. The higher figures may be due in part to the better quality of work required by government, but they are also due, I consider, to the arrangement under which the contractors' work is supervised by a staff of low paid subordinates who possess a greater power of control than can safely be entrusted to officers of this class. The remedy which I would suggest is that officers below a certain class should not supervise and should have no control whatever over contract

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[Continued.]

work, and that the subordinate staff of the Department should be employed solely on work which is being carried out by departmental agency and which cannot suitably be given out on contract. Eventually, I would restrict supervision over contract work to officers of the imperial or provincial service, or in the case of smaller contracts to senior officers of the upper subordinate establishment. Immediate effect could be given in part to such a measure without any strengthening of the superior staff of the Department, and the measure could be further developed if the existing arrangement of petty contracts were gradually replaced by the grant of larger contracts to more reliable private firms.

(3). The second defect to which I desire to draw attention is in the existing arrangement for financing civil works. The financial year ends on the 31st of March which in Burma is in the heart of the working season. During the rains, from May to October, work is necessarily stopped or retarded in most districts of the province. As a consequence the expenditure on any one work falls in most instances in two financial years at least, and the budget provision in each year has to be determined on a consideration of the proportion of the work which is likely to be completed and paid for before the 31st March. As that date approaches, work, whether undertaken by contractors or by departmental agency, is continually being rushed forward to an undesirable extent in order that the whole budget provision may be drawn before the end of the year. If a lapse of funds should occur the money saved will not be available for expenditure in the coming year in addition to any budget provision already made, and the work may eventually be stopped or seriously delayed for lack of full allotment of funds. When the 1st of April arrives the rush of work ceases, and it may be that little or nothing further can be done until the provision for the work in the budget for the coming year has been ascertained. On the other hand, it may be found desirable to carry out a work earlier in the season than had been anticipated when the budget provision was framed; but this greater despatch is rendered impossible owing to the restrictions placed on the rate of work by the provision in the earlier of the two budgets. Financial provision which separates and determines rigidly the amounts to be spent on a work during the earlier and the later parts of a working season and which may leave in doubt for some time the amount available in the later part of the season can result neither in efficiency nor in economy. A measure which I am convinced would materially improve the work of the Department would be to change the financial year, and to date it either from the 1st July or the 1st of October instead of from the 1st of April as at present. It may be, from the terms of reference, that the Committee are not prepared to consider a proposal of this nature, but I mention it here as the matter cannot well be ignored when measures for increasing the efficiency of the Department are under discussion. The proposal to change the financial year opens up a wide question which cannot be considered solely with reference to the needs of the Public Works Department. I may add, however, that such a change would, I believe, be to the benefit of Burma as a whole, and that I should welcome it in all the departments with which I am concerned.

2,791. (II.) Encouragement of other agency.—The proposal to give further encouragement to private

enterprise resolves itself, broadly speaking, in this province, into the substitution of large firms of contractors for the petty native contractors at present employed. The share of work which is being carried out entirely by departmental agency is unimportant. In my opinion the introduction of larger firms, wherever this course is found to be practicable, would be a sound policy to adopt. The amount of detailed supervision over work undertaken by a firm with a well-established reputation should be considerably less than is needed where petty contractors are employed, and the change would tend therefore to permit the discontinuance of such supervision by the subordinate staff. And if the larger contractors were offered important government contracts they would be encouraged to employ a better qualified engineering staff and to provide more openings for civil engineers trained in government engineering schools and colleges in India. Any such process would be gradual and it may be found in the beginning that outside Rangoon and one or two other large towns no private firm would be in a position to carry out work either on buildings or roads on more economical terms than can be arranged under the present system. I think, however, that this difficulty would eventually disappear if it were the declared policy of government that private agency should be employed as far as possible in carrying out such works, and if tenders were invited from time to time for all important works under both headings. I should expect that ultimately the great bulk of the work would be carried out at less cost and with advantage both to government and to private enterprise under such a system. There is no great scope for decentralization of work by the further employment of local bodies. District boards do not exist in Burma, and municipal and town committees undertake work on the buildings and roads in their charge with such engineering staff as they are in a position to employ. Except in a few large towns this staff is not capable of undertaking or supervising works of more than minor importance.

2,792. (III.) Changes in organization.—I should expect that with the further encouragement of private enterprise reduction should be possible in the subordinate staff of the Department, but I am not in a position to say how such a reorganization could best be carried out. I consider that no reduction is desirable or permissible in the superior staff. Whatever the agency employed, whether departmental or private, close supervision is needed by the superior staff of the Department if satisfactory results are to be secured, and this staff is none too strong in Burma at present.

2,793. (IV.) Relations with other departments and sub-branches.—Relations between the officers of the Public Works Department and officers of other departments have been clearly and satisfactorily defined, and in so far as funds will permit the Public Works Department is in a position to meet the needs of all other departments.

2,794. (VII.) Education.—There is no government engineering college in Burma. A government engineering school exists at Insein in which an elementary course of training is given to men who seek employment in the subordinate ranks of the Public Works Department or elsewhere. Arrangements have been made, I understand, by the headmaster of the school to give the students a practical course of work in private engineering works in Rangoon.

The HON'BLE MR. H. THOMPSON called and examined.

2,795. (President.) The witness stated that he was Financial Commissioner to the Government of Burma and that he had had 25 years' service the whole of which had been spent in Burma.

2,796. There were a number of municipalities in Burma, there being one at practically each district headquarters, in addition to notified areas to which certain sections of the Municipal Act applied. The larger municipalities employed their own engineering staff and undertook the construction and maintenance of their public works, but the smaller municipalities were only capable of

undertaking minor works, and works of importance were executed on their behalf by the Public Works Department. As he had no connection with municipalities he could not say definitely what statutory powers of control government possessed over their works or engineering staff. In the case of the smaller municipalities the power of control over the staff was vested in the Commissioner of the division.

2,797. There was a district cess fund in Lower Burma and a district fund in Upper Burma. The district cess fund derived its revenues from the levy of a cess of 10

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per cent. on land revenue and miscellaneous items, e.g., bazaars, ferries, etc. There were no district boards in Burma. The district fund was administered by the Deputy Commissioner, subject to the general control of the Commissioner, and its particular objects of expenditure were local roads, sanitation and education. The cess in each district was generally devoted to expenditure in the district in which it was levied, but the local Government had power to transfer a portion from one district to another. This power was, however, rarely exercised and when it was found necessary to effect a transfer the amount so transferred was generally repaid sooner or later. The district fund in Upper Burma did not derive its revenue from any cess on land revenue. It consisted mainly of moneys which accrued from bazaars, ferries, etc., and the receipts were consequently small. During the past two years grants-in-aid had been made from the provincial revenues to the Upper Burma district funds. Such contributions were made at the discretion of the local Government and did not form a regular item of receipt of the fund.

2,798. The question of creating district councils or district boards in Burma had from time to time been discussed and the general trend of opinion was that the time for their establishment in Burma was rapidly drawing near. The co-operative movement had shown that the ordinary Burma agriculturist was capable of taking an intelligent interest in local affairs. He could not say, however, whether the Committee could frame its proposals in regard to district fund works in Burma on the assumption that district boards would be established within a reasonably short period as he was not cognisant of the views of government in the matter.

2,799. The annual budget of expenditure of the district fund was framed by the Deputy Commissioner, and the policy with regard to the expenditure on roads varied. They had formerly been maintained by the Deputy Commissioner with the assistance of a district engineer, but recently it had become the practice to make over the amount needed for roads to the Public Works Department, who framed an estimate of the grants required on this account. The Deputy Commissioner acted under the control of the Commissioner in deciding the particular object on which it was proposed to spend money and consulted the Executive Engineer before framing his budget. The final decision as to whether a particular road should be constructed or maintained to a particular standard rested with the Deputy Commissioner subject to the approval of the Commissioner. Road programmes were drawn up by the Deputy Commissioners of districts in consultation with the Executive Engineers concerned and these required the approval of Commissioners and Superintending Engineers.

2,800. Deputy Commissioners formerly employed their own engineering staff for the construction and maintenance of district fund works, but the system had been abolished for some time past as it was found to be unsatisfactory.

2,801. Government had met the entire outlay on large water-works and drainage schemes from its sanitary grant, but this did not apply to small works. The sanitary grant was entirely at the disposal of the local Government and grants-in-aid were only made from it to those municipalities which could not afford to undertake such works without assistance. A town like Rangoon would be required to provide its own funds for its water-works schemes and the question of a grant-in-aid to other towns would depend on the financial position of the municipality.

2,802. The remark in his written statement that the Public Works Department rates were considerably higher than private rates was not based on any tangible data; his general impression was that a residential building constructed by the Public Works Department, though better built, was usually more expensive than a similar building constructed by private agency. He was not in a position to contradict the statement made in evidence by some of the officers of the Public Works Department that the cost of constructing a private building in Rangoon was approximately 25 to 30 per cent.

higher than that of a similar building erected by departmental agency, and mentioned that his statement did not have reference to buildings erected in Rangoon but to district buildings.

2,803. All the government buildings in districts were maintained by the Public Works Department and no buildings were maintained by the departments in occupation, but the Police Department occasionally constructed temporary structures from funds placed at their disposal. He had not considered the question whether the maintenance of buildings should be transferred to the department in occupation, in order to relieve the Public Works Department of a large amount of work which did not require skilled supervision, but was inclined to the view that it would not be feasible except in the case of repairs of a simple character. He was not in favour of transferring repairs of scattered buildings situated at a distance from headquarters, e.g., township offices, sub-treasuries, township judges courts, etc., to the officers of the township because he was of opinion that such officers would not be competent to effectually supervise the repairs of the buildings. Petty items of repairs, e.g., the replacement of broken window panes, were within their competence, but expert knowledge was required in the case for example of repairs to a roof or renewing a wooden post. His conclusion, therefore, was that the present system under which all repairs to buildings were carried out by the Public Works Department could not be improved upon and that the only alternative was to entrust the repair of government buildings to reliable contractors.

2,804. The main arterial communications, and certain district roads, were constructed and maintained by the Public Works Department and these works were financed from provincial revenues and district funds respectively. In his opinion this was the best and simplest arrangement for the maintenance of these particular district roads. He had had no recent experience as a district officer of the system under which a district managed its own roads, but mentioned that it had been abolished after an unsatisfactory trial.

2,805. There were practically no village roads in Burma other than those constructed from provincial and district funds. The village roads consisted chiefly of government paths and were maintained from district funds. A certain amount of responsibility was imposed on the villagers under the Village Act for the maintenance of road communications, but such responsibility was not generally enforced. The standard of maintenance varied according to locality and in some instances it was very difficult to enforce responsibility.

2,806. He advocated that private enterprise should be encouraged by government declaring its intention to give out all work on contract in future. It was true that the Public Works Department at present invited tenders for works, but it was not the declared policy of government that all works should be executed through the agency of contractors. He was not sufficiently familiar with the departmental procedure to describe what was actually done in the matter at present, but he had noticed that the district headquarters buildings in one district were being erected by petty contractors and was not aware whether the Department had in this instance called for tenders from large contractors. No district contractors were capable of undertaking the construction of large works.

2,807. Petty contractors were mostly Indians and there were practically no Burman contractors. This was possibly due to the Burmans not having had the opportunity of undergoing a training in this class of work. Building work did not appeal to Burmans as a rule and wherever such work was in progress it generally passed into the hands of Indians.

2,808. With reference to the view expressed in evidence by some witnesses that the direction staff consisting of Chief Engineers and Superintending Engineers was excessive, he considered that the Superintending Engineer was an important link in the organization of the Department, as his administrative position corresponded with that of a Commissioner. There were advantages in keeping

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the Public Works Department in close touch with Commissioners of divisions and Superintending Engineers helped to preserve this. If they were abolished that contact would be lost to a large extent, as Executive Engineers were merely district officers and frequently held charge of more than one civil district. He could not, however, definitely commit himself to the opinion that the Superintending Engineer performed functions which were necessary and that he played a sufficiently important part in the machinery of the administration to justify his retention. He had not given the matter due consideration and preferred not to express an opinion.

2,800 There were advantages in reorganizing the Department on a district basis, bringing it into closer relationship with the Deputy Commissioner and Commissioner and making the Public Works Department district correspond with the Civil district. He was doubtful, however, whether an Executive Engineer would under such circumstances be fully employed and to introduce the change each district would have to be sufficiently extensive to justify the appointment of an Executive Engineer to it. It would not be possible to place upper subordinates in charge of the smaller districts as it did not necessarily follow that work in the smaller districts would be of a less important nature. Subordinates besides were not competent to be placed in charge of districts. Hence if the Department were re-organized on a district basis in Burma it would not always be possible to provide sufficient employment for Executive Engineers.

2,810. The relations between the Executive Engineer and the Deputy Commissioner had lately been defined by the local Government. It had been laid down that the Executive Engineer was to be subordinate to the Deputy Commissioner for district fund works, but the former officer had a freer hand in the matter of provincial works. The question as to which roads should or should not be maintained would be determined by the district road programme but the arrangements for their repair and maintenance would rest almost entirely with the Public Works Department. The relations between the Executive Engineer and the Deputy Commissioner and the Forest officer and Deputy Commissioner were practically analogous, but they were somewhat closer in the latter case as the Forest officer was regarded as an assistant to the Deputy Commissioner in regard to forest matters. The question whether the Deputy Commissioner could issue instructions to the Executive Engineer hinged entirely on their nature. The Deputy Commissioner could probably issue instructions to the Executive Engineer in connection with district cess fund works, but he could not do so in regard to provincial works, nor was such interference necessary.

2,811. He was emphatically of opinion that the commencement of the financial year should be altered to either the 1st of July or 1st October. It was true that such alteration could not be made without due regard to the needs of other departments, but the change would be suitable to the departments with which he was acquainted and might well be introduced in the remaining departments. The defects of the present financial year were that it ended in the middle of the working season and thus greatly disorganized work. Work was rushed in March and there was a period of slackness in the months of April and May.

2,812. (Mr. Cobb.) He could not say whether the recent definition of the relations between the Executive Engineer and the Deputy Commissioner had introduced any material change in the position of the former, but Executive Engineers had been instructed to work in closer touch with the Deputy Commissioner in connection with district works. Closer personal relations between the Deputy Commissioner and Executive Engineer rendered it possible to carry out works with greater expedition. The Executive Engineer was subordinate to his own superiors in technical matters, but was under the orders of the Deputy Commissioner in matters of administrative interest. He personally had never experienced difficulty as a Deputy Commissioner in dealing with Executive Engineers in connection with the construction

and maintenance of roads which generally followed the road programme prepared in consultation with Executive Engineers, and had invariably found them willing to carry out his wishes. He had observed, however, that the funds provided for roads were never adequate.

2,813. He had not heard it suggested by the outside public that the Public Works Department preferred petty contractors, but his personal opinion was that large contractors did not receive sufficient encouragement from the Public Works Department as it had never been the declared policy of government that works should be given to such contractors.

2,814. In his opinion the time was approaching for the inception of local district boards in Burma. As he had not served in India, he could not say whether Burmans were more adapted than Indians for district board work, but he was of opinion that the Burman evinced an intelligent interest in local affairs. The Burman had acquired a sense of public responsibility and in a few years there would be no difficulty in securing suitable representatives on district boards.

2,815. (Sir Noel Kershaw.) The programme of road construction was drawn up by the Deputy Commissioner and Executive Engineer and the headmen and other leading men of the villages were informally consulted by the Deputy Commissioner or the township officer when drawing it up. The time was not ripe for convening a formal conference in all parts of Burma with the unofficial community before deciding on the road programme except in districts where the co-operative movement had been started. In his opinion the co-operative movement should be given a further trial and the question of the establishment of district boards held in abeyance in the interim. He was opposed to the conversion of the few advanced districts into district boards and advocated that the creation of such boards might be deferred for a few years after which the scheme could be made universal.

2,816. The reason which he had advanced for the retention of the Superintending Engineer, viz., that he brought the Department into closer touch with the Commissioner was not sufficient in itself to justify the retention of the services of that officer at an annual expenditure of about rupees two lakhs. He was of opinion that there should be some form of control over the Executive Engineer, but whether the technical control of the Superintending Engineer was worth the expenditure of rupees two lakhs a year was a question he was unable to answer as he was not aware what such control actually constituted.

2,817. He was very much in favour of diminishing the supervision at present exercised by low-paid subordinates whose salaries were less than Rs. 200 or Rs. 300 a month. By stating in his written memorandum that the higher rates of the Public Works Department were partly due to the arrangement under which the contractors' work was supervised by a staff of low-paid subordinates who possessed a greater power of control than could safely be entrusted to them, he did not mean to imply that the subordinates could not be trusted, in the sense that they were unreliable, but that they were not competent to exercise the standard of check which should be exercised over contractors, as their supervision was over minute. In his opinion a more highly paid man made a better class of officer and exercised more efficient supervision. He would also be able to supervise a larger number of works than a lowly paid man and be able to get more work done than the latter, and when contractors realized that their work would be supervised by a better class of officers, who would not worry them about details of little importance, they would turn out better work. His proposal would in fact make it easier to procure good contractors who would be prepared to do work at a reasonable cost.

2,818. (Mr. Samuelson.) If supervision by highly paid officers was substituted as suggested by him for the supervision now exercised, the actual cost of supervision would be greatly increased, but if good contractors were employed the amount of supervision now required would not be necessary. Good contractors would come

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[Continued.]

forward if it were made known that it was the intention of the government to give them encouragement. The exacting supervision at present exercised by the Public Works Department discouraged good contractors, but he did not know of any other practice which had a similar effect.

2,819. The main reason why the Burmans did not become contractors was that masonry work did not appeal to them: If a Burman undertook a work which consisted partially of timber and masonry he generally sub-let the masonry work to an Indian contractor. Technical education had not yet been sufficiently spread in Burma, but with its spread and better educational facilities good Burmese contractors might in course of time spring into being. He could not assert, however, whether the want of technical education was responsible for the absence of Burmese contractors as he was unaware what technical qualifications Indian contractors possessed.

2,820. (President.) The witness confirmed the statement made by some witnesses that Burma was very badly provided with roads. One of the reasons for this was that the province was a new one and that it had possessed practically no roads worthy of the name at its inception and it naturally required a great deal of money to construct a system of roads. An attempt was being made to construct new roads with the funds intended for maintenance under the provincial contract. The non-existence of roads in Burma at the time of its annexation was not merely due to the fact that road-

making had been neglected, but there were real difficulties in road-making owing to the nature of the country and the absence of road materials. In parts of Burma there was no stone or laterite, and *declone*, which was an inferior material, was utilized. He was not aware whether defects in the soil made it difficult to construct roads. It was very difficult to maintain a road in Lower Burma on account of the heavy rain. Anything short of a metalled road was unserviceable and metalling was very costly on account of the deficiency of stone. These conditions did not wholly apply to Upper Burma where the circumstances were different. Upper Burma had less need for roads as one could travel about the country without an elaborate system of roads. At the time of its annexation there were practically no roads except in one or two towns. Wheeled traffic in the country was confined to country carts and these were used only in the dry weather. Country carts could not be used in the deltaic districts. Transport was conducted by carts or boats as Burma had a plentiful system of waterways.

2,821. It was difficult to procure stone and other road-making materials in some parts of Burma. An inquiry had been instituted in connection with the framing of road programmes as to the possibilities of obtaining stone in various portions of the province and full information would be available as a result of this inquiry as to the centres where a suitable supply of stone was available.

MAJOR F. BIGGWILLIE, I.A., DEPUTY COMMISSIONER, YAMETHIN.

Written Statement.

2,822. (I.) Economy and suitability of methods of execution of public works.—I have been asked if I were willing to be nominated as a witness and have accepted with great diffidence as I cannot but feel that there are others who have more experience and whose opinion would carry more weight.

(2). My qualifications are not very great, but during the last 4½ years I have been in one district and done what I could to improve communications. Even a Superintending Engineer, who has strongly opposed my road-making on one occasion because I did not officially consult his Department, and has taken upon himself to tell me what the needs of my district are, has felt constrained to write that if I were to remain at Yamethin for a long time or if we were to be lucky enough to have in my successor a man as keen on public works there would not be much to complain of and so I venture to give my experiences and opinions for what they are worth.

(3). The present position as regards the agency by which public works are constructed in a Burma district is as follows:—As regards roads there are three classes. (1) those constructed and maintained from provincial funds, (2) those constructed and maintained from district funds and (3) those constructed and maintained by villagers. As only very few roads, perhaps only one through main road, come or will come under the first class it is evident that a Deputy Commissioner stands in very close relation to public works in his district.

(4). In the rains of 1912 (I took over charge in May 1912) I found, speaking generally, that the work of administration and trade facilities were greatly hampered by the inability to get about; for instance, to gain access to important charges within 10 miles of sub-divisional headquarters I had to swim my ponies three times and wade continuously in liquid mud up to my knees.

(5). In January 1914 the Commissioner of the division stated in Durbar that the result of our labours had been most satisfactory, that inter-village communications had been brought into existence and crime had decreased nearly 50% and also that private individuals had in a public spirited manner come forward, one with a donation of Rs. 10,000 for a bridge and another had also assisted very greatly in the matter of village communications and at a large cost. In 1915 the Commissioner in Durbar stated that headmen had clearly shown that they realized

their responsibility for keeping open and developing communications. In 1916, in his Village Administration Report, the Commissioner highly praised our communications and stated that there was not now a village that was not easily accessible in the rains. He was so pleased too that he made officers of other districts come and inspect and directed them to go and do likewise. In the local Government's last resolution on village administration, the following occurs:—"In the Yamethin District also remarkable success has attended the efforts of the Deputy Commissioner to improve communications. Though there was at first some opposition the villagers were quick to appreciate the advantages of open roads and willingly undertook the labour of their construction and maintenance with the result that there is no village that is not now easily accessible in the rains." These communications, however, have generally speaking consisted in the making of drained roads in villages and high and dry paths varying from 2' 6" to 5' wide between villages of which there are over 1,200, though in addition to the above, villagers have made some excellent bridges. And so I venture to think that with a little trouble and by working in co-operation with the people much can be done.

(6). The main lines of communication, however, that is the roads so-called of the district both provincial and those maintained by district funds, were and are in the hands of the Public Works Department. They too received my special attention but not, I regret to note, with the results that were reasonably to be expected, and the instances I will give will I think show that present Public Works Department methods are distinctly faulty.

(7). The first point of reference is "whether the methods at present adopted for the execution of civil works are economical and suitable for the purpose for which they were devised." I venture to state from my experience that they were neither the one nor the other. I can but go by results, but I must admit that given competent and keen men the results might have been very different.

(8). The following is an instance of particularly bad work. A road runs from Pyawbwe to Kyaukse, a distance of 7 miles. Some 3 miles purport to be metalled and the whole purports to be bridged and drained throughout. It connects two police stations and two bazaars and traffic is considerable. The yearly allotment for this

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road has been on the average of the last four years Rs. 2,822, i.e., for each year Rs. 2,670, 2,620, 3,000 and 3,000 respectively. In September 1912, I went along this road and wrote to the Executive Engineer officially as follows:

"I have the honour to bring to your notice the shocking and dangerous state of the Pyawbwe-Kyaukse Road. There is no doubt that any district officer who ventured to canter along it in the dusk or at night would break his neck. Even by day it is difficult to avoid the large and deep holes which obtain immediately adjoining some of the bridges. I should be very much obliged if you would take early steps to at least make the road safe to travel along."

In February 1913, estimates for sanding the 5th and 7th miles amounting to Rs. 750, and in March for metalling the 4th mile amounting to Rs. 2,007 were sanctioned by me. On 31st January 1914 I went along this road and was obliged to write as follows to the Executive Engineer in my letter No. 700—5P-13 of 2nd February 1914:

"I have the honour to draw your very early attention to the state of the Pyawbwe-Kyaukse Road. After leaving the metalled portion it is practically impossible to travel along it so deep and dangerous are the ruts and so rough the surface. I preferred the ditch. Please refer to my letter No. 811—5P-1, dated the 10th February 1913. I shall be glad if you will treat the matter as very urgent."

To this the Executive Engineer replied that the defects noticed would be remedied by the first week of March 1914.

My district has nearly 1,300 villages on an area of over 4,000 square miles and I did not get along this road again until 10th September 1914. I then had to write as follows in my No. 6262—5P-13 of 11th September 1914 to the Executive Engineer:

"I have the honour to draw your attention to the state of the Pyawbwe-Kyaukse Road. In several places the metalled portion is a quagmire, several of the bridges want attention and the heaps of sand that were apparently long ago put down on the unmetalled portion have been mostly kicked away by passing traffic."

No notice was taken.

I did not have occasion to go over this road again until 6th December 1915 and the following letter shows its state:—No. 8315—5P-3 of 7th December 1915 to the Executive Engineer:

"I have the honour to invite your most early attention to the condition of the Pyawbwe-Kyaukse Road. It purports I believe to be metalled; near Pyawbwe and its continuation through Pyawbwe as No. 2 Street, it is full of holes and it is hard to imagine any metal was ever put down. From the Pyawbwe side of Mozali-ang village up to Kyaukse it is a quagmire and to progress I was obliged to go along the fields and on the field *kazins* which afforded far better going. I found carts, pedestrians, riders all travelling through the fields in preference. There has of course been some rain the last two days but it is not right that roads that purport to be metalled should be impassable as soon as it rains. The road is an important one connecting two police stations and I must ask that district fund money be spent to better purpose."

No notice was taken.

I visited part of it again on 9th December 1916 and on 10th December 1916 wrote and requested "that the Pyawbwe-Kyaukse Road metalled part be attended to very early before the rains really set in" adding that I had not yet been beyond Mozali-ang.

On 17th June 1916, I traversed the road and on 18th June 1916 wrote as follows:—General Department No. 4425—5P-31 of 18th June 1916:

"I have the honour to invite your most urgent attention to the condition of the Pyawbwe-Kyaukse Road. The main point is that at mile 6 the road is non-existent, its place being taken by a deep swamp. Even this afternoon, and we have had no rain at all for some days, I was unable to ride across and had to drag my pony over. Both sides of bridge M5 B1 there are heaps of sand which have been there, the villagers tell me, a considerable time. In many other places the road

needs repair and there is not a sign of any work being done upon it (here follows a para. about another road). The previous correspondence speaks for itself and I must ask you to very kindly give your very early attention to the matter." Then I received the following letter which is at least illustrative of the lack of supervision on the part of the Executive Engineer, his sub-divisional officer and overseers.

Executive Engineer's letter 5107 of 17th July 1916. "In reply to your 4425—5P-6, dated the 18th June 1916, I have the honour to say that a spillway is required at M 6—1 for which I will have an estimate prepared. Since taking over the road from the district fund several culverts have been built the road never having been completely bridged.

(3). This is stuff which has been rejected.

(4). Orders were given to contractors for sand and *lankar* some months ago but I regret to find that they have failed to complete their contracts and that in consequence this road is likely to be in poor condition throughout this rains. They have been repeatedly reminded but make the usual excuses. I am making fresh arrangements."

To this I replied as follows: General Department No. 5240—5P-31 of 20th July 1916:—

"I have the honour to acknowledge with thanks receipt of your letter No. 5107 of 17th July 1916 and I anticipate from the tone of it and the ready admission of the bad state of affairs a speedy improvement. I trust the estimate for the spillway will come along very soon. The rejected stuff can doubtless be removed or utilized and not allowed to block the road. Contractors, you will pardon my stating, require supervision and your sub-divisional officer does not appear to have exercised it."

I hope the new arrangements you are making will soon make the road usable for mounted men at night. The road connects two police stations and is the means of access to criminal villages."

On the same date 20th July 1916, the Executive Engineer complained that villagers were encroaching on the road and had made bunds and were holding up water on the berm tracks so the carts would not use same and I at once issued orders for the removal of these encroachments.

It was not till September 1916 that I got an estimate for a spillway at M 6—1 for Rs. 1,312+24½ per cent. = Rs. 1,633. I asked if I found the money now whether work would be put in hand at once and receiving a reply in the negative decided that money must be provided from the next budget.

Such is the history of one of our roads. I would urge that no private contractor could have done worse, that had I had an overseer paid for from district funds to keep this simple road in order it would have been always in order and that for such work as described above the overseer would have been dismissed.

(9). This is by no means the only instance and the following letters which indicate the state of affairs during the last few years prove, I venture to think, that present methods are neither economical nor suitable, or are at least susceptible of much improvement.

(a). General Department No. 5021—5P-1 of 4th October 1912:

"I have the honour to state that I have just had occasion to ride along the Pyawbwe-Shawbyugon road. I did so at the risk of my neck and a pony with me fell badly nearly killing its owner.

The approaches to some of the bridges are similar to those on the Pyawbwe-Kyaukse Road characterised by large and deep holes and are most dangerous. I would be glad if you would kindly issue urgent orders to so repair the road as to make it safe to travel over."

(b). General Department No. 5173—5P-1 of 13th October 1912:

"I have the honour to state that I rode over the Lewepedonmyaung Road *via* the Pylonchantha tank to-day. It is almost impassable even for a pony, and I had to dismount—it is quite impassable for laden carts, one of which I found hopelessly bogged. There is too a most

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dangerous bridge just opposite the sluice-gate of the tank. I got on to it and off it at great risk in broad daylight. There are large and deep gaping spaces immediately in front of the bridge on the Lowe side. Any district officer who might well have to go along this road at night or at dusk would assuredly break his horse's legs and his own neck. I would ask you to very speedily have the road made safe and if possible made passable for cart traffic."

(c). General Department No. 5387—5P-1 of 24th October 1912 :

"I have the honour to draw your serious attention to the state of the Thawatti-Inbin Road.

About a quarter of a mile from Inbin village on the Thawatti side the road was so bad I was unable to ride along it owing to the deep and dangerous quagmires. Further some of the bridges close to this place had dangerous holes in the planks.

I must ask you to have this matter seen to very urgently as it is an extraordinary state of affairs that does not permit a district officer to visit an important village except in broad daylight without the certainty of breaking his neck."

(d). General Department No. 5652—5P-1 of 12th November 1912 :

"I have the honour to invite your attention to the state of the Court House Road in Pyawbwe, particularly that portion of it leading from the railway station entrance to the north. And of this portion the part which most requires attention is that at the corner where the road takes a bend across the railway line. The bridge near by has for long had loose planks and the corner becomes a swamp whenever it rains. Would you please have this seen to as soon as possible as there is heavy traffic on it.

(2). I would further ask you to be so good as to have the heaps of earth, etc., which have long been left unspread on the Pyawbwe-Shweda road spread as soon as possible. Coming into Pyawbwe last night in the dark, I had the utmost difficulty in picking my way past these heaps and there is no warning at all of their existence until one comes upon them.

(3) I would also bring to your notice the fact that I have received complaints of the state of the Pyawbwe-Yanaung Road, particularly at the Pyawbwe end of it and where it passes Pettaw village. The ruts are apparently deep and dangerous and would bring a pony down at night. I would ask you to very kindly have this too seen to."

(e). General Department No. 5906—5P-1 of 25th November 1912 :

"I have the honour to state that the second bridge on the Yanaung-Thapanchaung Road a few yards only from Yanaung is in a condition most dangerous to passengers; near the centre of the bridge parts of two planks are missing and through these gaps cattle and horses can place their feet. Again at the approach to the bridge on the Yanaung side, there is a space of some four or five inches between the bridge and the road equally calculated to bring any horse and rider to serious grief. My horse put his foot into this death trap but luckily it was a hind foot and so he is still alive.

From enquiries I find that this bridge has been in this condition for the last month.

Would you please have it repaired very urgently?"

(f). General Department No. 6233—5P-1 of 10th December 1912 :

"I have the honour to send you the following extract from the diary of the sub-divisional officer, Pyinmana, dated 10th November 1912, and to request that you will please have the matter seen to at once:—

The road to Nganzat is passable for carts, but that is about all. In several places the Public Works Department have built up culverts which have been left uncovered. In two or three places, the slabs intended for the bridging of the culverts have been lying at the side of the road for months. They were certainly there when I went this way July last. By Nganzat itself the road is bad and coolies have to take one's kit for a mile or so till near Maungyan where carts can again be utilized,

Please treat the matter as urgent."

(g). General Department No. 6028—5P-1 of 28th November 1912 :

"I have the honour to request that you will be so good as to let me know what steps you are taking this cold weather to put the Pyawbwe-Yindaw Road in repair. I have provided a sum of Rs. 4,254 for this purpose. I shall be glad if you will have the road put in order as soon as possible. We are at present losing trade by its impassable state, the trade is being diverted to other districts."

(h). Executive Engineer's No. 9047-21 A. Y. of 9th December 1912 :

"With reference to your letter No. 6028-5P-1, dated the 28th November 1912, and subsequent reminder regarding the Pyawbwe-Yindaw Road, I have the honour to inform you that the work provided in the sanctioned estimate will be done this year.

(2). Sanctioned estimates in original for maintenance and special repairs are herewith enclosed for information and favour of early return."

(3). No notice was taken of most of the letters and so I issued reminders and received the following collective reply:—

Executive Engineer's No. 9129-21 A. Y. of 12th December 1912 :

"I have the honour to state that I have received several reminders from you to-day all regarding roads, etc., the necessity for which you have been good enough to bring to my notice, and in reply to them collectively I would state that I am personally much obliged to you for bringing these defects to my notice, but I would at the same time say that the letters never appeared to me to call for replies in each case since action has been taken in every instance and the repairs have as far as possible been done forthwith."

It is seen that it is stated that action has been taken in every case and the repairs as far as possible done forthwith.

During this year a sum of Rs. 70,600 was put at the Executive Engineer's disposal of which Rs. 65,802 was for communications and Rs. 28,566 of this for repairs.

In January 1913 an estimate for special repairs to the Lowe-Pedonmyaung Road item (b) above was sanctioned.

On 12th January 1913, I found nothing had been done to the Pyawbwe-Yindaw Road (items g and h above) and wrote to the Executive Engineer as follows:—

General Department No. 340—5P-1 of 20th January 1913 :

"I have the honour to request a reference to your letter No. 9017-21 A. Y., dated the 9th December 1912, and to state that I travelled over this road on 12th January 1913. It is still impassable. Will you be able to put it into thorough order this dry season? Many bridges are required, particularly one near Sadaung."

The following letter shows its condition:—

General Department No. 3809—5P-13 of 27th June 1914 :

"I have the honour to state that the condition of the Pyawbwe-Yanaung Road, especially the first two miles is very bad indeed and to request that you will kindly take immediate steps to put it in order.

(2). The same is the case with some two miles of the Pyawbwe-Yindaw Road between Sadaung and Kyini which is always bad."

Up to and including 1916 progress along this road each rains has been very difficult.

(10). I would add that Pyawbwe and Yanaung are township headquarters and Yindaw is a criminal charge with a police station.

The roads leading out of Yanaung are partial quagmires during the rains, on the Pyawbwe-Yanaung Road a quagmire and the roads to the police stations of Yingatkon and Kyundon have been greatly neglected. Gaps at bridge approaches have been common. By a little attention on the part of the sub-divisional officer, Public Works Department, in charge matters would have been easily prevented or remedied. This has been particularly wanting throughout this northern sub-division.

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(11). As regards item (f) above, the Taungnyo Road, the following letters show its state:—

General Department No. 4358—5P-3 of 25th June 1915:

"I have the honour to invite your very early attention to the Taungnyo Valley Road between miles 10 and 13. I have just come over it with extreme difficulty although we are only at the beginning of the rains and although there has been no rain in this neighbourhood for about ten days, the ruts and quagmires are now so deep and dangerous that I had constantly to leave the road and come along the ditch. This road leads to an important police station. Last year at your sub-divisional officer's special request, I gave some extra money, Rs. 2,000 I think, to have it put in thorough order. Pyinmana people have complained that they cannot hire carts to come along it in the rains. Can nothing be done to make the bad part usable? Every year the same state of affairs exists and I have good reason to know that this is the cause of the Forest Department declining to pay any more towards cost of maintenance."

General Department No. 4826—5P-3 of 14th July 1915:

"In continuation of my letter regarding the state of the Taungnyo Road, I have the honour to state the sub-divisional officer, Pyinmana, reports, 'that at present the road is practically impassable, that a pony cannot be ridden and transport is possible by elephant only, that at this time last year the same state of affairs existed and that a forest officer could only get along by treading in the steps of his elephant.' He states nothing has been done since I wrote to you. I would add that I saw a considerable quantity of sand had been collected which was lying idle and I have been informed that all work was suddenly stopped, even the utilizing of the already collected sand. I would point out that Taungnyo police station is an important one and that means of access thereto are urgently needed."

Executive Engineer's No. 5784-100-C. of 22nd July 1915:

"With reference to your No. 4826—5P-3, dated the 14th instant, I have the honour to refer you to correspondence ending with this office No. 5684, dated the 20th July 1915. Sand collection and spreading which should have been done in the dry weather had to be stopped for want of funds. Work can rarely be put in hand directly funds are given, arrangements have to be made and tenders called for."

Executive Engineer's No. 7731—10-C1-1 of 28th September 1915:

"With reference to your No. 4358—5P-3, dated the 25th June 1915, and subsequent reminder, I have the honour to say that I hoped to be able to get over this road but have not yet been able to do so."

The road being an unmetalled one it is impossible to keep it in good order throughout the rains except at prohibitive expense. Sanding is being done and will be continued each year from the maintenance grant, but it will be some years before we get the full benefit of this.

The Forest Department I understand is adverse to a metalled road and want one that they can take elephants along."

As regards item (c) it has remained in bad order up to and during 1916.

And for item (d) the state of affairs has been equally bad, *vide* para. (10) above and letter No. 8093—5P-3 of November 29th 1915 is an instance of the approaches to Pyawbwe.

General Department No. 8093—5P-3 of 29th November 1915:

"In continuation of my letter No. 8087—5P-3, dated the 27th November 1915, I have the honour to state that I have now inspected the approaches to the second large bridge on the Pyawbwe-Yamethin Road close to Pyawbwe. The hole is about 18 inches in diameter and very deep and the approach is very dangerous. I shall be obliged if you will have it repaired at once and not write and say that your motor car can traverse this hole. District officials ride ponies and would be very likely to break their ponies' legs and their own necks at

such places; I would also ask you to kindly have these roads and bridges inspected and attended to regularly. It is not well that I should so often find them in such a state."

Regarding (c) I do not happen to have traversed again in the rains.

And as regards (b) the state has been continuously bad as yearly letters show.

And for item (a) suffice it to state that for want of a small timber bridge 10' wide I found all traffic suspended and wired to Executive Engineer on 12th June 1916 and wrote at length on 13th June 1916. No notice was taken until 1st July when the Executive Engineer wrote he had given a contract to the nearest village headman for a temporary cart bridge. Considerable delay occurred even then; and I could have got the work done in two days.

(12). Another road and a very important one connecting district headquarters with a township headquarters on which there is much traffic and which is part of the main through route from the districts on the south and north of Yamethin is the Yamethin-Pyawbwe Road and it has every rains been in bad order notwithstanding that Rs. 3,718 a year has been allotted to it on the average, i.e., for each of the last four years Rs. 3,251 Rs. 4,420, Rs. 1,700 and Rs. 5,500 respectively.

The following correspondence shows the state of affairs:—

General Department No. 3030—5P-1 of 24th May 1913:

"I have the honour to invite your attention to the condition of the Yamethin-Pyawbwe Road. It is already very bad and apparently repairs have not been completed. If they have they are worse than useless. I refer to that part of the road from Yamethin to mile 2½. I may point out that traffic along it is heavy. I have never been on this road, and I go along it frequently, without passing from 30 to 50 laden carts."

General Department No. 4441—5P-1 of 17th August 1913:

"I have the honour to state that to get from Yamethin to Pyawbwe on 18th August 1913, I was obliged to avoid the first seven miles of the direct road (so called) as being too bad to travel with safety on horseback. I came to Kadin on the Yanaung Road and joined the direct route a little south of Shweda-Thazi. Between the 7th and 8th milestones the road is still very bad indeed, and further on towards Pyawbwe, irrespective of the creek crossings and the sudden and dangerous drop at one creek, there are places susceptible of great improvement. I trust you will have at least a passable track made."

General Department No. 6262—5P-13 of 11th September 1914:

"I have the honour to draw your attention to the state of the Pyawbwe-Kyaukse Road. In several places the metalled portion is quagmire, several bridges want attention and the heaps of sand that were apparently long ago put down on the unmetalled portion have been mostly kicked away by passing traffic. I noticed the same thing on the Pyawbwe-Yamethin Road. Heaps of sand before the first level crossing were left an unreasonably long time without being spread."

General Department No. 4784-5P-3 of 12th July 1915:

"I have the honour to state that I have this morning been over the first seven miles of the Yamethin-Pyawbwe Road. A great deal of money has been spent on it and there has been a certain amount of improvement. For some distance before the level crossing the surface is extremely rough and holes immediately in front of the bridges are appearing and are dangerous. I see that sand has been accumulated. The portion in front of Magyigon village is very bad and still a quagmire. I see no cause at all for the swamps at mile 5-4. The road here could I think be easily raised and a culvert made. I find this swamp every year. I trust you will do what is possible and arrange to prevent the road becoming impassable."

Executive Engineer's No. 5684 of 20th July 1915:

"With reference to your 4784—5P-3, dated the 12th July 1915, I have the honour to say that a special

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repairs estimate recently sanctioned provides for embankment at miles 2-6, 5-2, 5-4, 5-6, 7-3 and 8-1. This will be put in hand and completed, but you must not expect those new embankments to settle down for a year or two."

General Department No. 5585—5P-3 of 19th August 1916 :

"I have the honour to inform you that the Pyawbwe-Yamethin Road between Pyawbwe-Shweda requires much attention. It is in very bad order at and near Shweda and I would suggest that the sand near Mindan, for long piled up on the roadside, be utilized. The road leaving Pyawbwe for Kyaukse before it crosses the creek near Kyi-ang is getting into bad order.

Extract from General Department No. 8087—5P-3 of 27th November 1916 :

"* * * * * It is reported to me that the approaches to the fairly large bridges on the Yamethin-Pyawbwe Road as it enters the town are in very bad order, * * * * *

General Department No. 3554—5P-6 of 12th May 1916 :

"I have the honour to invite your very early attention to the state of that portion of the Yamethin-Pyawbwe Road which passes Hlwe-U village which lies between Kintla and Ingying. It is even now very much broken up and with deep ruts, but if taken in hand at once it will not, I hope, become an impassable quagmire of which there is otherwise every likelihood."

I may add that this part remained a swamp until the end of the rains, and on 13th November 1916, I traversed this road and had to write as follows :—

General Department No. 8095—5P-6 of 13th November 1916 :

"I have the honour to state that the Yamethin-Pyawbwe Road is in a bad state in many parts. Where it passes Hlwe-U village just before reaching Ingying it is very bad, a deep bog. I warned your sub-divisional officer that this part would not stand any rain at all. For years I have had to come *via* Kadin during the rains and cut across and join the road at Shweda. This year the Shweda-Pegon part and the part on the Pyawbwe side of the level crossing close to Pegon is bad."

(13). The following is an instance of excessive delay in constructing a bridge over a creek that crossed an important thoroughfare. On 5th August 1915, I asked for an estimate. On 8th September 1915 I got the estimate, promised the money in April and asked the Executive Engineer to start work in March and on 23rd November 1915 said I would be glad if the bridge be put in hand as soon as possible. On 9th June 1916 I found the bridge not completed and had to make a long detour and also found the roadway quite unconnected with the bridge and wrote to the Executive Engineer.

On 23rd June 1916 I visited again and wrote and wired that communications were interrupted and on 24th June 1916 wrote that nothing had been done and no attempt to join up the road with the bridge had been made and I pointed out that it was particularly required for use in the rains.

On 14th October 1916, I found the road still disconnected with the bridge, it apparently having been washed away.

Any contractor would have done this for me within a few days. I think that the above instances disclose a deplorable state of affairs and are very disheartening to any officer anxious to have decent communications in his charge.

(14). Everywhere there is lack of supervision. An important cart suspension bridge was constructed on the Lwe-Shanzu Road of this district by the Public Works Department. I have not the details of all that occurred, but I believe the promotion of the Executive Engineer was stopped and the services of the sub-divisional officer, Public Works Department, dispensed with. A new house for the Civil Surgeon, Yamethin, was constructed. Some

of the tiles fell off very shortly after it was occupied and white-ants came up through the floor shortly after it was laid. There is not a district bungalow in Public Works Department charge that has been kept in proper repair. A new and expensive hospital at district headquarters has just been built, yet the walls of the operation room are cracked badly due to sinking and the following is an extract from the inspection notes of the Inspector-General of Civil Hospitals of 27th December 1916 :—

"The dispensary is a new building on the type plan which is not satisfactory as there is no waiting room accommodation and no proper room for examination of patients which is done now in the minor operation room. The room containing the patients' clothing requires ventilating, either a small window made or perhaps iron bars could be fitted to the present window so that it could be left open. The hospital kitchen is too small and some provision should be made in the shape of a chimney to take off the smoke. The cementing of the tiled floor is not well done, there being gaps in many places; irrespective of the cracks caused by the sinking of the buildings. The large earthen-ware stone seats in the latrine have been laid down at an angle in two cases; but the pattern of the seat is wrong by design to start with, the places for the patients' feet having been made on a slope instead of flat or sloping the reverse way. The operation room has become badly cracked through sinking of the building which is apparently continuing. No proper drains have been constructed round the building and the water from the bath rooms and W.Cs. now passes on to the ground close to the building which is decidedly objectionable. If funds cannot be provided for a proper drain, it might be desirable to have filter-pits made at the place where the small drains end."

(15). As regards economy, I think there is no doubt that the Public Works Department are very expensive and that large profits are made by their contractors. I wanted an important cart bridge made and the Public Works Department estimated the cost at Rs. 11,280 *plus* 24½ per cent. I had an excellent bridge made to their specification for Rs. 5,000. Of course I got duty-free timber and for the rough work of hauling logs, free labour and free sawing. And the Rs. 5,000 was privately subscribed, so urgently did the people want the bridge, a work a Public Works Department officer took upon himself to say was unnecessary. I could have got a contractor to do the work for Rs. 10,000.

But for important works and those really requiring skilled supervision I doubt whether anything more economical could under existing circumstances be devised.

(16). For ordinary unmetalled roads with their unimportant bridges such as obtain in the Yamethin district a Deputy Commissioner could get work much more cheaply done at least as effectively as is now the case.

It is government policy to secure that a Deputy Commissioner who takes an interest in the improvement and extension of communications should have greater opportunities for carrying out his views than is possible with the restricted revenue of his district fund. Hence Financial Department Circular No. 12—1M-26, dated 3rd February 1914, issued and in accordance with it I took over five roads. I attach this circular.*

And it is hoped that when Circular Public Works Department Resolution No. 407-53A of 8th June 1916 is applied, there will be a continuous programme of works and repairs and the happy-go-lucky work and wasteful expenditure that has hitherto prevailed will be put a stop to. I attach a copy* of this also. But until the Public Works Department and its working are vastly improved the hope is, I am afraid, a vain hope.

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[Continued.]

(17). *Causes of bad work.*—(a). The primary cause of bad work is the divorce of the Public Works Department from public opinion and from the knowledge of district requirements as expressed by the wishes of local officers. The officers of the Public Works Department resent any suggestions from district officers as to local requirements and do not think it incumbent on them to acknowledge suggestions from the head of the district. The illustrations I have given prove this. It is a particularly bad point and shows callous indifference to district needs of which they can and do otherwise know nothing. The danger anticipated in paragraph 15 of Public Works Department Circular No. 250-508E* of 1911 has been more than realized and the hopes expressed have utterly failed to mature. The Public Works Department has gradually taken to itself not only the decision as to how things shall be done, but also the decision as to what things shall be done. The order and urgency and importance of works are consequently largely determined by a department entirely out of touch with public opinion and without any knowledge whatever as to the works necessary for general administrative purposes.

(b). The second cause of bad work is the divorce of the Public Works Department administration from the district as the unit of administration. Public Works Department administration, whether for local or imperial works should be closely allied to district administration. It is only from district officers that the relative urgency and importance of local works can be ascertained and even in provincial works, district administrative officers are in a better position to advise as to requirements than the officers of a bureaucratic department. Public Works administration will be costly, inefficient and dilatory until it can be brought into close touch with district administration. The suggestion that the Deputy Commissioner is too over-worked to supervise Public Works administration is unfounded. The present Public Works administration causes an energetic Deputy Commissioner ten times the work and worry that he would have in supervising the public works of his district assisted by a competent engineer.

(c). A third cause of bad work in the Public Works Department is the contempt of the Department for outside criticism and suggestions. My Executive Engineer desires to retain a monopoly of all works, even the most petty. He is bitterly opposed to the scheme outlined in Circular 407-53A.* In this district communications are mostly sand tracks but as they have petty timber bridges or small culverts he maintains that expert supervision is necessary to maintain these petty bridges and culverts as well as to control the administration of all works. In view of the total lack of supervision exercised in this district the contention is more amusing than admirable. It does not require an expert to tell if the roof of a bungalow is leaking over a bed, as I have so often found they do leak, nor if there is a gap of 18 inches or several feet between a road and a bridge as I have so often found, nor if a road supposed to be metalled is a foot deep in mud. I cannot imagine even a village headman, much less a district fund overseer of mine, leaving his communications in such a state as necessitated an acrobatic feat to get over the " yawning chasm " between track and bridge and equal agility to avoid tumbling through the bridge when one did get on to it. The control of a district officer actually on the spot and continually using the works constructed, even though he may not be an expert, is much more effective than that of an expert Superintending Engineer who possibly visits the works once in two or three years, after giving due notice. It is wonderful the speedy patch work that is done to let the Superintending Engineer pass. It has been urged too by my Executive Engineer that some Deputy Commissioners might not be active enough to go about and see things for themselves. This contention is absurd and such

Public Works Department officers who are so anxious to keep all these petty works in their own hands quite ignore the existence of sub-divisional and township officers, the District Superintendent of Police and the Assistant Superintendents of Police and the Superintendent of Land Records who have to get about and can quite well keep their Deputy Commissioner informed of the state of the communications. Besides a Deputy Commissioner is bound to tour.

(d). A fourth cause of bad work is the ignorance of officers of all grades of the Public Works Department of the conditions and the people of the province. They have had (most of them) Indian training and experience and are quite incompetent to utilize the Burman. They are tied to Indian methods, Indian labour and Indian contractors and these are necessarily expensive. The work done by the Public Works Department is in the hands of Indian contractors and workmen and they enjoy a monopoly with all its evils. The notorious subservience of the lower officials of the Department to these contractors is largely due to their dependence on this Indian monopoly.

(e). A fifth cause of bad work is the insufficient and bad supervision on the part of Public Works Department officers. Their charges are perhaps much too big. They certainly do no adequate supervision. The Superintending Engineer's occasional and hurried tours, after due notice, in which he can superintend nothing, are sheer waste of time and money. The Executive Engineer has failed to do anything, even to see his sub-divisional officers do their work.

The supervision of these upper subordinates is very bad and they are, it is believed, not trusted by the Executive Engineer. The lower subordinates are, as has been stated, afraid of and in the hands of the contractors. Throughout the Public Works Department the capacity to demonstrate practically what ought to be done to secure good work seems to be wanting. Practical training has been wanting. Roads have been made on mud without solid stone. A " permanent " bridge was constructed in the Sagaing district which had to be renewed twice in five years. Permanent works are now starting and we want people who can do them.

(f). A sixth cause of bad work is the fact that all the works of the year have to be crammed into a period of about three months ending the 31st March instead of continuing as they ought to do the whole of the open season, say till the 31st May.

(g). A seventh cause of bad work is that an Executive Engineer has to do far too much office work in relation to estimates and has to spend much of his time in battling with the Accounts Department.

(18). No doubt circulars 12-1M-26* and 407-53A* will do something to put right the happy-go-lucky and wasteful expenditure that has hitherto obtained, but the real remedy is to make the district the unit of public works executive administration for all works local and provincial under the control of the Deputy Commissioner assisted by a competent engineer. The initiative and execution of all local works should be absolutely with the Deputy Commissioner subject only to certain technical sanction in the case of works over a certain amount. The initiative in provincial works should remain with the local Government, but the execution of them should be carried out by the district engineering staff. In short, the executive work of the Public Works Department should be abolished. It should be an integral portion of district administration. The Public Works Department should be purely an inspecting, supervising and advisory body.

(19). (II.) *Encouragement of other agency.*—The second point of reference is " whether under the existing system private enterprise is sufficiently encouraged and whether it is possible and desirable to entrust the construction and upkeep of certain classes of public works

* Not printed.

* Not printed.

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[Continued.]

to agency other than departmental and, if so, upon what lines such changes should be effected." As regards the latter part of this reference, I would refer to my previous paragraphs and as regards the former part private enterprise probably is sufficiently encouraged in Rangoon and as regards districts it would under existing circumstances, with no Burman firms, be impracticable for private firms to take up local works.

2,824. (III.) Changes in organization.—I have no remarks to offer.

2,825. (IV.) Relations with other departments and sub-branches.—It will be obvious from what I have said above that I do not consider the Public Works Department meets the needs of district officers in any way. As to *inter se* relations, this is a matter for experts.

2,826. (VII.) Practical training.—There is a crying need for much more practical training.

2,827. (General.) I have endeavoured to show the position in which a Deputy Commissioner does and should stand to public works in his district and that while I have succeeded in improving village roads, I have been

unable to do anything for provincial and district fund roads, because they are in the hands of the Public Works Department and I therefore very strongly recommend that every Deputy Commissioner should have under him a competent district engineer who would not only look after all district fund works, but would also do all works for government.

(2). If this recommendation is not acceptable the Public Works Department should be improved by bringing it into touch with public opinion, by making it work through the Deputy Commissioner, by making it an integral portion of the district administration, by giving it the valuable aid of the criticism of the public, by making it a Public Works Department in reality, a department carrying out works wanted by the public, used by the public and subject to public criticism and control. I have done my best to make a bad system work and have failed. No one, except those interested in the continuance of the existing system, can fail to object to bad work, procrastination, unnecessary delay, waste of public money and inefficiency and incompetency.

MAJOR BIGGWITHER called and examined.

2,828. (President.) The witness stated that he was a Deputy Commissioner of 4½ years' experience all in one district.

2,829. The village roads (present not new classification) in his district were more or less drained and were wholly under his charge. Village roads or paths were constructed by digging a ditch on either side of the selected site and piling up and consolidating the excavated material, and the village communications which he had made a special effort to improve were about two feet six inches to five feet wide; in some cases they had been widened into cart roads. They were not only located inside village areas but also connected villages. Between fields in all cultivated areas there existed *kazins* or field embankments. These held up water and were being widened where they connected villages to about five feet so as to enable people to ride along them at any time of the year. They were not, however, suitable for cart traffic.

2,830. The name of his district was Yamethin. It was situated in Upper Burma, and was about 275 miles from Rangoon.

2,831. The villagers were responsible for the upkeep of their village tracks or roads in good order under the Village Act. The Deputy Commissioner possessed statutory powers to enforce that responsibility, the penalty for non-compliance with his orders being a fine of Rs. 50 or a month's imprisonment. He had never had occasion to exercise his statutory powers for the enforcement of responsibility and the latter had always been secured by executive action, and by enlisting the co-operation of villagers.

2,832. There were two classes of roads outside the village tracks; namely those constructed and maintained from provincial and district funds respectively. The district fund derived its revenue from the sale of bazaars, slaughter houses and miscellaneous auctions held each year. The annual income of the Yamethin district fund, which was not a cess fund, was approximately Rs. 92,500, and the objects of expenditure to which the fund was devoted were the maintenance of bazaars, communications and the payment of establishment charges. The maintenance of communications was the main item of expenditure and as a matter of fact an average of Rs. 58,700 of the income of Rs. 92,500 had been spent thereon yearly.

2,833. He employed a district fund bazaar and sanitary establishment but what he most needed was a Public Works Department establishment. He was under the impression that when he was in Lower Burma in 1910 the employment of a district public works establishment had been started as he himself had employed a district fund overseer when he was a sub-divisional officer. The abolition of district engineering establishments was, in his opinion, a mistake, as each district

should be held responsible for its roads and the expenditure of its funds. He had not studied the report and publications in regard to the abolition of these establishments but had observed that, since their abolition, local works had not been executed satisfactorily. He supported his view by referring to paragraphs 5 and 6 of the Government of Burma, Public Works Department Circular No. 407-53-A., dated 8th June 1916, in which it was stated that the existing arrangements for the execution of work had not proved satisfactory and remarked that this was due to the inability of district officers to get sufficient attention paid to their works. The circular laid down that the Deputy Commissioner was responsible for district fund works to the extent that he selected and provided funds for them and that the Public Works Department was the agency for carrying out his orders. These conditions, however, had not yet come into force but he was sure they would be a great help. He quoted instances in which the Executive Engineer had not carried out his instructions in regard to district fund works and remarked that such cases would be largely obviated by the instructions laid down in the circular. What he actually wanted was a district engineer of his own. He also referred to paragraph 9 of the circular in question in which it was laid down that the Executive Engineer would cause the Deputy Commissioner to be supplied as soon as possible after the close of each month with a statement showing the progress made during the month in respect of each individual work and stated that he hoped to receive these reports from the 1st April 1917.

2,834. District fund roads were composed of earthen embankments with a few timber bridges, and sand was spread on their surface. If kept in good order, they were serviceable even during the rains. The class of soil varied a great deal. One metalled road in Pyinmana was constructed on black soil and had been found difficult to maintain as it had no soling or foundation. If an ordinary road had a foundation it could be maintained efficiently even in a district with a rainfall varying from 30 to 66 inches, as in his district.

2,835. The district staple was paddy and paddy was cultivated in clayey soil on both sides of the Pyawbwe-Kyaukse Road, some three miles of which was supposed to be metalled. The metal for the road had possibly been obtained from Shwemyo a distance of about 30 or 40 miles by rail and this made it difficult to maintain the road efficiently.

2,836. The bridges along the Pyawbwe-Kyaukse Road were small timber bridges and their construction did not require skilled labour. These bridges had all been constructed by the Public Works Department but the villagers had recently constructed them in other places satisfactorily. They consisted of timber piles driven

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into stream beds and planks supported by timber beams. The approaches to the bridges on this and other roads were not kept in a proper state of repair by the Public Works Department as there were nearly always gaps between the ends of the bridges and the approach roads, caused by the embankments of the approaches leading to the bridges continually falling away. It was therefore desirable that the approaches to the bridges should be repaired constantly, possibly this had not been done in the past owing to the insufficient provision of funds for the purpose by the district fund, but all funds asked for were supplied and lack of experience was the cause.

2,837. The district fund budget provided certain specified sums for road repairs, and the Executive Engineer intimated his requirements to the Deputy Commissioner who endeavoured to provide the necessary funds therefor. The requirements of Executive Engineers were not usually reduced to any appreciable extent unless they asked for large grants. Recently, a sum of Rs. 50,500 had been asked for and this had been reduced to Rs. 41,450. Roads could be re-classified in accordance with the new scheme, and those for which money could not be found would be classed as 'G' or village roads and maintained by the villagers with the exception of the bridges thereon, for which financial assistance would be given.

2,838. When a new road had to be constructed the funds for which would be provided from the district fund, the Deputy Commissioner consulted the Executive Engineer in the matter of its cost and lay-out. The Executive Engineer was not concerned with the question of its necessity and the decision in this connection rested with the Deputy Commissioner. There was ample time for the Executive Engineer to make arrangements for the execution of a work as the district fund budget was settled about December and intimation was given to the Executive Engineer on the 15th December as to the grant for expenditure from the following April.

2,839. He was of opinion that the rates of the Public Works Department were high and cited the case of a bridge for the construction of which the Public Works Department estimated Rs. 11,280 plus 2½ per cent. for departmental charges, whereas he had constructed it, without expert supervision, to the specification of the Department for Rs. 5,000 after collecting all the materials at the site of the work. He added that a contractor had been willing to undertake the entire construction of the bridge for Rs. 10,000 but admitted that it would not be safe to allow a contractor to build a bridge of this size without supervision. He had taken the risk in the case of the bridge in question because he could not get it built in any other way. It had stood the biggest flood on record.

2,840. The Executive Engineer was at present entirely independent of the Deputy Commissioner. But in accordance with the new circular the Executive Engineer would construct works in the order decided by the Deputy Commissioner. The Forest officer in the district also worked independently but that officer very rarely, and in his district had never, refused to carry out the Deputy Commissioner's wishes. His relations with the Forest officer and the Executive Engineer were practically on a par, but he possessed a little more control over the latter officer in the matter of the provision of funds for works.

2,841. He recommended the reorganization of the Public Works Department on a district basis, viz., that each district should be the unit and that the class of officer to be posted to it should be regulated by its normal expenditure on public works, as he considered that the Public Works Department were, at present, far too independent and too much divorced from the district administration. The Department, he added, were not cognizant of the needs of each district and their only means of ascertaining them was through the district officer.

2,842. In his opinion, the Superintending Engineer was an unnecessary link in the chain of responsibility, if reliable upper subordinates who were competent to advise on technical matters were posted to the districts

in which the expenditure justified their employment. In other cases superior supervision would be necessary. He had not considered whether the district engineer he advocated should be a member of the Public Works Department proper, or whether he should be an officer appointed by the Deputy Commissioner, but in any case an efficient and reliable man would be necessary.

2,843. Under the existing system all works of the year had to be completed within the months of January to March, but he believed that this system had just been changed.

2,844. There were a few Chinese and Indian contractors in his district who were capable of undertaking the construction of fairly large works, e.g., a district court house costing Rs. 50,000, under supervision. The former class of contractors, however, chiefly undertook the wood-work in a building. The Public Works Department had recently constructed a hospital costing about Rs. 50,000 under their supervision, but he did not know whether the work was undertaken by a single contractor.

2,845. The reason why the Burman had not taken to contracting work was that he had never attempted it or been encouraged to attempt it, and he considered it desirable that the Burmese should be encouraged in this direction. In irrigation districts contracts were taken up, he believed, exclusively by Indians. The credit for the large recruitment, in comparatively recent years, of Burmese students to the Insein school, was due to the present principal.

2,846. Under the recent circular all petty works which did not require skilled supervision were entrusted to the Deputy Commissioner. The classification of works rested with the Deputy Commissioner but in cases in which there was a difference of opinion between that officer and the Executive Engineer the matter had to be referred to the Commissioner.

2,847. (Sir Noel Kershaw.) There were, he thought, between 32 to 38 districts in Burma, but there were no district boards at present though the time seemed to be ripe for their creation. He would certainly welcome a district board in his own district as it would be of help to him in arousing local interest.

2,848. (Mr. Mackenzie.) The Executive Engineer had charge of two other districts besides his and this handicapped the former in the matter of the supervision of works. The major portion of the work in his district could be executed by a far less highly paid officer and it was desirable that the unskilled works in his and other districts, e.g., unimportant roads, wooden bridges and culverts should be separated from the skilled work.

2,849. A number of small bridges had been constructed by headmen who had not allowed gaps between the ends of the bridges and the approach roads. He did not know why gaps occurred in other bridges but it was probably due to the road being sheer perpendicular with the result that when a cart approached a bridge it removed some of the earth. One could not therefore get on to a bridge without one's pony putting his foot into a hole. He had not inquired of the Executive Engineer how to remedy this as such cases occurred solely on the Executive Engineer's roads and it was his business to put in order the defects pointed out by the Assistant Engineer. Lack of supervision was the cause, but he desired to point out that the Executive Engineer held charge of three districts and probably had not the time properly to supervise his subordinates' work. He could not say whether the subordinate responsible for the repair of the bridges on the Pyawbwe-Kyaukse Road was an upper or a lower subordinate. He had not seen the upper subordinate in charge of the upper half of his district as that officer was constantly being changed and lived outside the district at Thazi and also held charge of a portion of another district. The upper subordinate in charge of the lower half of his district was, however, a very keen and efficient officer who had constructed bridges over large streams.

2,850. He would certainly welcome the creation of a district board even though this would involve his being elected chairman and consequently increase his work.

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2,851. He had not come across a case in which an Executive Engineer had deliberately disobeyed the Deputy Commissioner's orders, and was of opinion that the Deputy Commissioner and Executive Engineer generally worked in harmony as the former was always recognised as the head of the district and his instructions were generally carried out.

2,852. (*Mr. Cobb.*) Cases in which a Deputy Commissioner could not induce an Executive Engineer to attend to work were referred to the Commissioner who in turn brought the matter to the notice of the Superintending Engineer.

2,853. The same difficulty in inducing Burmese to take up contracting work applied also to their performing *coolis'* work. Public Works Department labour was chiefly undertaken by Indians, and while it would not be practicable to obtain mixed Indian and Burmese labour it was quite possible for officers who knew Burmans and their ways as no Public Works Department officer knew them to get Burmans to do good *coolie* work or any other work, as was well proved by their enlistment as soldiers, an entirely new venture.

2,854. (*Mr. Samuelson.*) The bridge he had constructed for which he had previously collected all the necessary materials on the spot, cost Rs. 5,000 for the labour of putting the materials together and for the whole of the iron which the contractor had supplied. Another contractor had intimated his willingness to construct the bridge for Rs. 10,000 without any assistance. In works constructed by the Public Works Department the departmental charges amounted to 24½ per cent and supervision in the construction of the bridge might have helped considerably. The length of the bridge was 180 feet and it consisted of three spans each of 60 feet.

2,855. He had once given a grant of Rs. 28,000 to the Executive Engineer for the annual repair of roads. He was not sure what number of miles of road the Executive Engineer had to maintain for this amount but he believed that it amounted to less than 100. The cost of maintenance of the Yamethin portion of the Grand Trunk Road was Rs. 50 per mile, but this was a provincial road and the amount was allotted presumably by the Superintending Engineer.

E. J. PULLAR, Esq., F.R.I.B.A., Architect, 10 Phayre Street, Rangoon.

MR. E. J. PULLAR called and examined.

2,856. (*President.*) The witness stated that he was a private architect in Rangoon and that he had practised as such for about 12 years.

2,857. There were no architects in Rangoon, besides himself, who were members of the Royal Institute of British Architects, but there were several individuals practising as architects who possessed no recognised diploma and there was no law which prohibited their doing so. It was not absolutely essential for an architect to be a member of the Royal Institute of British Architects, but in his opinion many of the individuals who called themselves architects had no qualifications at all. One or two of the architects in Rangoon were Europeans, but he was not aware whether any of the others had received instruction in the Indian engineering colleges.

2,858. The architect who designed a private building also undertook to supervise its construction and this was the only manner in which an architect could get his work done satisfactorily. An architect did not employ a clerk of works and he himself did not do so. If a clerk of works were employed he would be engaged by the owner and placed under the control of the architect, but a clerk of works did not form part of the architect's ordinary office staff. When supervising the construction of a building designed by himself he sometimes asked the owner, in cases of necessity, for a clerk of works, but it was difficult to procure a suitable man and as a rule there was no intermediary between the contractor and the architect. He visited all his works which were in progress in Rangoon daily and some of them more frequently. The contract for a private building was entered into between the contractor and the owner, and payments were made by the latter on the architect's certificate. The contractor prepared his own bills and these were passed on by the architect to the owner with a certificate for payment.

2,859. He generally charged the scale of fees laid down by the Royal Institute of British Architects, but there were exceptional cases in which he had to modify the scale. The fee was not calculated with reference to the estimated cost of the work, but on its actual cost.

2,860. He agreed with the suggestion that government should rely on the open market for its architectural requirements either by employing a private architect for a particular work or by calling for designs by public competition, and considered that there was no reason why works in Rangoon should not be carried out satisfactorily by private architects as there were men in Rangoon who, though not members of the Royal Institute of British Architects, were quite capable of undertaking

architectural work, and there were a sufficient number of private architects to ensure competition. He was not in favour, however, of the abolition of the Government Architect's appointment on the understanding that government would have all its architectural work done by private architects, as he considered there was sufficient work in Burma to justify the retention of the appointment. There was in fact justification for an increase in the staff of the Consulting Architect. He himself had officiated in the post and had found that it involved really more work than one man could possibly cope with. Important works should be entrusted to the Government Architect, but on the other hand there was a good deal of work at present carried out by Executive Engineers which could be done more efficiently and economically by private architects, and the question of its distribution between government and private agency should be left to the discretion of the Consulting Architect who was in the best position to judge what he was able to cope with and what should be handed over to private architects. There was a danger that the Government Architect, under his proposal, might be inclined to suggest an increase in his staff rather than hand over works to private architects, but he was of opinion that an increase in the Government Architect's staff as well as the transfer of certain works to private architects was desirable. Of the two alternatives open to the Consulting Architect on occasions when he had more work than he could cope with, *viz.*, (a) to suggest an increase in his staff, and (b) to transfer certain work to private architects, he considered the former would be much more expensive than the latter.

2,861. There were three or four reliable firms of building contractors in Rangoon. The European firms employed their own engineering staff and *mistris* in place of clerks of works and the others often employed no staff at all. He had worked out the private rates for the construction of buildings in Rangoon, but could not compare them with the government rates as the latter included departmental charges and other items. He had seen the government schedule of rates in Rangoon, but had not compared it with the prevailing private rates, and could not say off-hand how the estimates for private buildings, the designs of which had been prepared by him, compared with those of the Public Works Department. His knowledge of the government rates was insufficient to enable him to say whether private buildings in Rangoon were more or less expensive than government buildings, but he expressed surprise when he was told that one witness had stated that the private rates in Rangoon were approximately 25 to 30 per cent. higher than the government rates, as he thought there was hardly so great a difference between the two.

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Though he had not made a comparison, he was inclined to the view that the government rates were very much the same as the rates for private buildings and this had been his opinion, as far as he could remember, when he was in government service.

2,862. In private practice separate tenders were ordinarily invited for steel-work and the remainder of the building. As a result of this method satisfactory tenders were received for the construction of the building, excluding steel-work, and there was sufficient competition in Rangoon to ensure this. He was not aware of the government system for inviting tenders for work in Rangoon.

2,863. His firm did not give an architectural training, and he had not received pupils, either Burmans or others, for this purpose.

2,864. As an architect he considered himself responsible for the structural stability of buildings he designed and he did not count upon engineering firms checking his plans in this respect. He was emphatically opposed to the view that an architect was primarily responsible for the outward features of a building, and that the engineer was responsible for its structural stability. This view, in his opinion, was an erroneous one as it was impossible to design a building without a knowledge of construction and of structural and building materials. The outward features of a building besides were inseparable from the construction of the building as a whole, and they could not be dissociated in working out a design. Hence it followed that the man who designed a building was in a better position than anybody else to supervise its construction.

2,865. The post of Government Architect should invariably be held by a fully-qualified architect with English experience, and his recommendation for the recruitment in England of Architects applied to Burma where there was no scope for local recruitment. In his opinion, the Architects so recruited should be Associates, or Fellows of the Royal Institute of British Architects, and should have had three to five years' practical experience as principals. Their age should not be less than 30 and his reason for suggesting recruitment at a fairly advanced age was to secure men with larger practical experience. As regards the terms of appointment of Architects, he was of the opinion that these officers should be appointed on a permanent and pensionable basis instead of on short term agreements. He was not in favour of the proposal to engage a man for a short period of about five years, and to replace him on the termination of his agreement by another engaged on similar terms and conditions, and did not think such a system would work smoothly as it would offer no encouragement. It took a man several years to settle down to the conditions of the country and to dispense with his services after he had become familiar with them would be a mistake. He did not think Architects would come out to India temporarily for the sake of the larger opportunities which the country afforded and of acquiring a knowledge of Indian conditions, as they would thus lose touch with their former practices during their absence, and not prosper as well on their return to England. If he were in England, he personally would not be prepared to take up employment in India for a period of five years.

2,866. He considered that a great deal could be done by the creation of a school of architecture in India, in the direction of teaching Indians and Burmans building construction and training them as draughtsmen and supervisors. He had visited the Insein School of Engineering. The curriculum of the school provided for an elementary course in architecture and he once gave a series of lectures on the subject at the request of government. These lectures were, however, discontinued after a short time as they had been considered unnecessary. No students from this school were employed by his firm, but when he officiated as Government Architect he employed two boys as apprentices in his drawing office, both of whom turned out very promising. The Insein school was an excellent institution, but he thought it should provide for more practical training in building construction and the use of materials.

2,867. As the standard of masonry, brick and stone-work was very low in Burma he approved of the suggestion to recruit a number of craftsmen from England for instructional purposes. He considered the proposal an excellent one and that a trial of the experiment would result in much improvement in the standard of work.

2,868. (Sir Noel Kershaw.) As a rule there was not much work in progress in Rangoon and the largest amount of work which he had had at one time consisted of three or four buildings costing about three to four lakhs of rupees. These buildings were not far apart from one another, and he himself had supervised their construction without any assistance, as he preferred to do so. This arrangement had, of course, necessitated the contractors carrying out the works without supervision for long periods, but he had impressed on them the necessity of referring direct to him whenever they were in doubt. He had never found that the contractors substituted sand for mortar, or lime for cement during his absence and there was small likelihood of such an occurrence because of his periodical visits, and of the fact that a reliable firm would not descend to dishonest work. As far as he was aware his supervision had proved adequate. It was much less than the supervision exercised by the Public Works Department in the case of a similar building, but the supervision which the Public Works Department exercised was mainly through subordinates and was of little value, as such subordinates could only see to the proper mixing and use of materials. The Department, he added, exercised only little supervision in construction itself. The mixing of materials, etc., was no doubt of great importance, but he had never had cause for complaint in this connection.

2,869. In the case of a building erected by the Public Works Department the Architect was never in touch with the building, or the builder, and the entire supervision was conducted by the executive staff whose supervision could not possibly be so good as that of the Architect, as the designer of a building was in a much better position than anybody else to see that the work was carried out according to his ideas.

2,870. At the request of the Pasteur Institute Committee he had specially employed a man to supervise the construction and mixing of materials, etc., of the Pasteur Institute building. He had been able to secure a reliable man for the purpose in this instance but he generally experienced difficulty in obtaining a suitable man. It would be of advantage to employ such men if they were available and he would be prepared to engage them provided the owners were willing to pay for their services. The non-employment of such men was, however, not due to the unwillingness of the owners to pay for their services, but to the fact that they were not available. If men of this class were available, he would advise the owners to employ them on works.

2,871. Ordinarily a clerk of works would suffice for the supervision of each building, but the question as to the size of building one man could supervise would depend on its nature. If the General Hospital in Rangoon which cost about 40 to 45 lakhs of rupees had been undertaken as a private work two qualified clerks of works would have been sufficient for supervisory purposes. They would have had to be brought from England and paid Rs. 350 to Rs. 450 a month plus their expenses of coming and going.

2,872. He did not object to importing clerks of works from England, but to employing the man available in India as he was absolutely unqualified for the work. He would rather not have anybody than have such a man. A fully qualified man from England would be of great assistance and save a lot of trouble. One clerk of works, provided he was a thoroughly qualified man, was sufficient for the supervision of an ordinary building in Rangoon. The charges for the supervision in the case of a building similar to the General Hospital, Rangoon, would consist of the Architect's fees for the preparation of the plans and the remuneration of the clerk of works.

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[Continued.]

The former would amount* to 5 per cent. on the cost of the building and this charge would cover the drawing up of the plans and supervision but not quantities.

2,873. (*Mr. Mackenzie.*) When he designed a building for a client he did not recommend the use of government bricks. He had used both government and private bricks and considered that the bricks obtainable in the open market were as good as government bricks though they were a little more expensive and could be had for about Rs. 20 per thousand. The prices of ordinary building bricks and pressed or facing bricks varied considerably, and there was a sufficient quantity of the ordinary bricks available in the open market. Hence there was no necessity for the maintenance of a government brickfield. Bricks of fairly good quality were available in Burma, and their standard could easily be improved. Government bricks were not of a very superior quality but they were somewhat superior to private bricks.

* Mr. Pullar afterwards wrote :—

"I have the honour to inform you that the method I should propose to adopt, for the design and construction of government buildings entrusted to me, would be as follows:—

(a). *Site.*—Particulars of site, climatic conditions, and local building materials would be ascertained, and, if necessary, I should visit the site."

(b). *Plans.*—Preliminary sketches, for approval of government, and full working drawings and bills of quantities and estimates would be prepared by me.

(c). *Supervision.*—In Rangoon, or neighbourhood, I should supervise the work myself; and if up-country, I should rely upon the Public Works Department staff, but no one below the rank of a senior man in the upper subordinate establishment. He would have full workings drawings, etc., and would be in direct communication with me. I should also, when possible, get the contract taken up by a firm (European or native) who have worked for me before and thoroughly understand an architect's drawings, and the class of work I expect done. In this way, the risk of mistakes would be lessened and supervision could be reduced to a minimum. I should also endeavour to visit the works periodically during construction.

I may add that several private buildings up-country have been erected satisfactorily from my designs, without my supervision.

(d). *Fees.*—The scale of fees sanctioned by the Royal Institute of British Architects would be adopted, viz. :—

5 per cent. on the cost of building, for plans and supervision or 2½ per cent. on the cost of building, for plans only. 2½ per cent. on the cost of building, for bills of quantities.

The above scale does not apply to buildings costing less than Rs. 15,000, where the rate would be slightly increased, according to the cost of the building.

Travelling expenses to be paid by government."

The Hon'ble Mr. J. E. Du BERN, VICE-PRESIDENT, RANGOON MUNICIPALITY.

The Hon'ble Mr. J. E. Du BERN, called and examined.

2,881. (*President.*) The witness stated that he had known Burma since the year 1880 and that he had been in business for the past twenty-three years as a merchant in Rangoon; also that he had for the past nine years been the vice-president of the Rangoon Municipality.

2,882. The Rangoon Municipality employed its own engineering staff for its several branches of work. The Chief Engineer was directly in charge of buildings and roads work, and the Deputy Chief Engineer of sanitary and water-works schemes. In addition a few Assistant Engineers were engaged for the supervision and mechanical work.

2,883. The municipal engineer did not prepare the designs for large buildings, and the designs, plans and specifications for such were thrown open to public competition. The last occasion on which resort had been had to this procedure was for the construction of the Town Hall at an approximate cost of Rs. 25,00,000 and about 80 plans had then been received from all parts of India and England. The system could thus be regarded as having proved successful. The services of private architects were not required for the preparation of designs for the smaller buildings as such designs

The rate for government bricks did not justify government bricks being used in place of private bricks, and the existence of the government brickfield discouraged private enterprise to some extent. The reason why the government brickfield turned out bricks a little cheaper than private persons was that the cost of land and the materials and instruments necessary for their manufacture was not debited to the cost of their outturn.

2,874. A qualified architect was as capable as, or even better qualified than, an engineer to supervise the construction of a building which he had designed, as he devoted his whole life to the study of designing and the construction of buildings. An architect would consult an engineer in the case of complicated steel-work, but he would not need such assistance in the case of ordinary steel-work. An engineer's advice might also be useful in the case of special foundations, but any ordinary building could very well be designed by an architect who would assume full responsibility for its structural stability.

2,875. The importation from England of quantity surveyors would be an advantage and there would be ample work for them.

2,876. During the last few years there had been more government work in Rangoon than private work, but the ratio of government to private work was not anything like ten to one.

2,877. (*Mr. Cobb.*) His objection to the employment of temporary Architects applied equally to Assistant Architects who he considered should also be engaged permanently.

2,878. If a school for architects were established it would take much longer than five years to produce architects, and individuals trained in the school would not be properly qualified unless they also underwent a course of training in England.

2,879. The Rangoon Municipality did not employ an architect as they had very little building work. They, however, employed an engineer to supervise their works. The municipality had had an architect a few years previously and the only important building that the municipality had erected since then had been designed by that officer.

2,880. (*Mr. Samuelson.*) If he was responsible for the supervision and construction of buildings scattered over a large area he would be obliged to employ a clerk of works if one was available, and it would not be possible for him to exercise the daily supervision which he ordinarily performed in cases in which buildings were in a compact area. He advocated that the local agency of the Public Works Department might be utilized in such cases subject to the Department remaining in closer touch with the Architect.

were not in any way involved. Tenders were invited for entire works, with the exception of the supply of sanitary fittings, for which separate tenders were called for from sanitary engineering firms. There were a few large contracting firms in Rangoon which were capable of undertaking large building projects.

2,884. He could not say whether the municipal rates as a whole were cheaper than those of the Public Works Department, but mentioned that the rate for laterite and for the metalling of roads was lower. One of the reasons, in his opinion, for the Public Works Department rates being higher was that the Department fixed a rate for the purpose of preparing their estimates which was really much higher than the actual rate, for which such work could actually be carried out, and as such fixed rates were commonly known contractors combined to work up to the former rate knowing that the local competition was not sufficiently keen to upset the combination. He doubted whether the private rates in Rangoon were nearly 20 per cent. higher than the government rates, and added that another reason why the Public Works Department rates were higher was that considerable modifications were frequently made

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[Continued.]

while a work was in progress which frequently necessitated the dismantlement of certain portions of work and the payment of higher rates for their re-erection, whereas in the case of a private building the full requirements were known at the start, thus resulting in cheaper construction. In support of the assertion he instanced a case in which he originally quoted a rate of Rs. 1-2 for marble, on behalf of a marble importer; this work was subsequently paid for at Rs. 1-0 or Rs. 1-8, and stated that the difference in the total expenditure had proved considerable.

2,885. He was in favour of the splitting up of contracts, e.g., the giving of wood-work to one contractor, masonry to another and so on. It was true that such a system would handicap large contracting firms, but nearly all the firms in Rangoon sub-let their contracts.

2,886. The courses which he suggested for the encouragement of private enterprise were the making of prompt payments, and the invitation of tenders for all works. The former, in his opinion, would obviate the present necessity for the borrowing of money by contractors at higher rates of interest. As regards the latter, he admitted that it was the practice to call for tenders in Rangoon.

2,887. The witness stated that he was an engineer by profession and had constructed his own ice factory, and that he had at one time been attached to the construction branch of the government Telegraph Department. He knew several engineers and accounts officers, and was of opinion that the present system of audit was defective inasmuch as the accounts officers had no knowledge of engineering. He accordingly advocated that the Accounts Branch should form an integral portion of the Public Works Department, and that with the exception of a few senior officers all the officials who were actually engaged on auditing the accounts of the Department ought to have an intimate knowledge of the details of construction.

2,888. He considered that the Sanitary Engineer to Government should be a specialist and not an official who had received no training on sanitary works. He was unable to agree that the demand for sanitary works in Burma did not justify the appointment of a specialist and considered that the appointment of a specialist would lead to a material improvement in the sanitary condition of the country. His experience of sanitary works in Burma was limited to Rangoon, but he had had experience of large works in Europe which had been designed and erected by large sanitary engineering firms. Sanitary

schemes in Burma were at present often formulated by doctors who were mere faddists, and lived ahead of the Indian requirements but he did not think that a specialist in sanitary engineering would be subject to the same influences, as he thought that such an individual would better appreciate his works.

2,889. He advocated promotion by merit in place of seniority and mentioned that the present system often denuded ambition and interest in an otherwise capable young officer.

2,890. (Mr. Cobb.) The Rangoon Municipality carried out its repair work departmentally, and possessed a workshop, but he was not in favour of the establishment of small workshops. The materials for works were not supplied by the municipality.

2,891. He did not consider the Public Works Department rates were restrictive and that they hampered contractors in any way. The municipality worked at cheaper rates than the Public Works Department, and exercised as much supervision as that Department, and municipal members sometimes also watched the construction of works.

2,892. (Sir Noel Kershaw.) The municipality in fact exercised closer supervision over their works than the Public Works Department owing to the staff of the latter being undermanned, and Executive Engineers being given charges which were far too extensive to ensure close supervision. In these circumstances he thought the supervision of the Public Works Department could not be as efficient as was desirable.

2,893. He was opposed to the view expressed in evidence that private buildings cost 25 to 30 per cent. more than those constructed by the Public Works Department, and stated that he personally had constructed a building 13 years previously at cheaper rates by supervising its construction himself, thus saving Rs. 10,000 on a building worth Rs. 50,000. The margin allowed by private contractors for profit in their quotations was at least 16 per cent.

2,894. (President.) The manufacture by government of its own bricks was justified as the bricks obtainable in the open market were generally inferior in quality. Good private bricks could, however, be obtained by special arrangement.

2,895. (Mr. Samuelson.) The municipal schedule of rates was not a confidential document and contractors tendered more with reference to the rates than to the value of work to be done.

M. OPPENHEIMER, Esq., Representative of the Rangoon Trades Association.

Written Statement.

2,896. I am a merchant and have passed 26 years in Burma. My firm, although government contractors, do not undertake building contracts of any kind whatsoever. The Rangoon Trades Association has no member representing the building trade.

2,897. (I.) Economy and suitability of methods of execution of public works, and (II.) Encouragement of other agency.—I am not aware that private enterprise is sufficiently fostered in the direction of construction of original works. I feel sure many of our local contracting firms are prepared to construct roads and bridges and carry out the work to the satisfaction of Public Works Department officers appointed for their supervision. Some of our largest and latest public buildings have been erected by local contractors and successfully too. In regard to maintenance of such public works, I am of the opinion this would be done more economically by the Public Works Department, as owing to the nature of their work a large staff must always be maintained and they must be kept employed.

2,898. (V.) Decentralization.—Maintain the Central Stores as a distributing centre and continue to import such articles, not ordinarily obtainable locally, such as new lights and spares for the light-houses and ships, spare parts of pumping and electrical plants installed, special sections of bridging materials for renewals, etc.,

but as importers of building materials such as cement, reinforcing materials of sorts, mamooties, pick-axes, shovels, felling axes, crow bars, saws, corrugated iron, steel beams, nails, paints, oils, varnishes, disinfectants and many other articles, I certainly am of the opinion that government would be well advised to make its purchases of these lines locally by inviting public tenders. All goods to be at least equal to a standard maintained in the Central Stores of the Public Works Department. Keen prices would thus be quoted, and I feel sure government would score not only in this respect but also in freshness of stores thus obtained. Waste and loss would be prevented. At present many of the above mentioned articles are only purchased locally when the supplies at the Central Stores run short or extraordinary demands for emergency or famine relief works are made.

2,899. (VIII.) Practical training.—It is my opinion that young men who have passed an engineering college should be attached to a division for practical training in a similar manner as Indian Civil Service men newly appointed are attached to district headquarters for practical work before being given independent charge. Engineers who are entertained by private firms have all had practical training for a long while in one of the large engineering establishments in Great Britain before being accepted and given charge of independent work.

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MR. M. OPPENHEIMER.

[Continued.]

MR. M. OPPENHEIMER called and examined.

2,900. (President.) The witness stated that he was a merchant in Rangoon and that he was the representative of the Rangoon Trades Association.

2,901. No building contracting firms had any connection with the Rangoon Trades Association. His own firm did not take up government building contracts, but contracts for the supply of clothes and accoutrements for government departments *e.g.*, the Police and Forest Departments, *etc.*

2,902. With regard to his recommendation for the freer purchase, locally, of stores, he was informed that it had been put forward in evidence that an average for a specified period, between the cost of articles purchased locally and those obtained by indent through the Secretary of State, showed that the former was 25 per cent. dearer than the latter. He thereupon remarked that this was due to the exemption of government from import duty and the better terms given to the state by shipping companies. For instance, shipping companies generally took the risks that mercantile firms had to insure against, *e.g.*, breakage and shortage of articles, and he expressed the belief that government had secured such advantages through gentle pressure. In his opinion a further reason for the difference and a perfectly legitimate one was that government were able to secure cheaper rates owing to their purchasing stores in bulk. But he added that owing to government purchasing stores locally only when they ran short of their requirements, firms ran up their prices knowing that government would be compelled to pay them.

2,903. He considered that no local firm would agree to supply cement at the rate it was at present obtained through the Secretary of State, for a period of five years, owing to the fluctuations in the market. He thought the experiment would, however, be worth a trial if no definite rates were fixed, though he believed it had already been given a trial and been abandoned. He added that the practice was in vogue in connection with the supply of the requirements of the Police Department.

2,904. He then remarked that the main consideration in the matter of the economical local purchase of stores was competition, and, so long as government could be assured of this, they could confidently look forward to

a reduction of 17½ per cent. in the present Indian rates, provided the remaining 7½ per cent., which represented import duty, was eliminated from the calculation. In his opinion, the competition in Rangoon was sufficiently keen to effect the desired reduction.

2,905. In regard to the recommendation in his written evidence that private building enterprise ought also to be encouraged he stated that there were competent firms in Rangoon for the construction of buildings, roads, bridges, *etc.* But he was in favour of the division of work according to its importance and magnitude in order to benefit all contractors whether large or small. To the contention that such an arrangement would not be favourable to large contractors, he replied that the future would show whether such contractors really executed work with their own establishments.

2,906. (Sir Noel Kershaw.) He attributed a portion, 17½ per cent., of the difference between the rates at which stores were obtainable from England by the Public Works Department and private firms, respectively (which remained after the exclusion of 7½ per cent. import duty) to the non-payment of storage duties and interest on the value of goods which latter in the case of firms amounted to 6 per cent; and added that the average period for which goods were thus stored was 60 days.

2,907. He maintained that government paid less freight on stores as they were not compelled to secure themselves against breakage to the extent firms had to, and added that the reason for the difference in the treatment accorded by shipping companies was that government were their regular customers and dealt with them more largely. A further reason for the difference between the two rates was that a private firm had to allow for its profits, but he admitted that all the reasons he had urged did not account for the entire difference of 25 per cent.

2,908. (Mr. Cobb.) In his opinion a private firm could not hope to compete with government in the matter of the purchase of stores because of its limited resources, and the question whether government paid more or less accordingly did not affect them as acutely as it did a firm. He had, however, been able to supply the Railway Department with certain articles, at cheaper rates.

At Rangoon, Friday, 9th March 1917.

PRESENT:

F. G. SLY, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

A. T. MACKENZIE, Esq.

C. S. COBB, Esq., M.V.O.

And the following Co-opted Member:—

B. M. SAMUELSON, Esq., M.I.C.E., M.R.S.T., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary).

T. O. FOSTER, Esq., F.R.I.B.A., Consulting Architect to the Government of Burma, Public Works Department.

Written Statement.

2,909. Much of what I have to say will be in answer to the first subject of inquiry "whether the methods at present adopted for the execution of civil works are economical and suitable for the purpose for which they are devised". As regards civil works I shall confine my remarks to buildings. Although I have been only working under the Government of India and Burma

for a little over 3 years, it has been sufficiently long to enable me to give a decided negative to this question.

2,910. In the early stages of development in the province, building was of much less importance than the large engineering works connected with roads, railways, canals and ports, and it was quite natural that the engineer should have been placed in control of all works. But as the average annual amount spent on public

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[Continued.]

buildings in Burma in the last ten years, not including military buildings, comes to, in round figures, Rs. 24 lakhs,* it is evident that building has assumed a position of primary importance, and that it is to government's interest to get the best possible return for so much money. Government do not and cannot get the best return at present because officers, who have an excellent training in their own profession, are saddled with the duties of another profession equally technical, in which they have no previous training. As the relative importance of public building in India has increased, this anomaly has become apparent. Instead of seeking a solution, a palliative was tried in 1901 by bringing from home a Consulting Architect to Bombay. In recent years this experiment has been increasingly tried. In 1910 two Architects were brought out. In 1912 three, in 1913 four and in 1914 five. War conditions have intervened since, so that 1915 and 1916 do not afford us any assistance. But these figures are evidence of the growing conviction that public buildings cannot be best designed and constructed by engineers without any training as architects. It was an attempt to render the old system workable by the aid of an expert adviser. In my opinion it has failed.

2,011. In this connection I may refer to the qualifications of the men brought out to fill the posts of Consulting Architect. They must be over 30 years of age, either a Fellow or an Associate of the Royal Institute of British Architects, either in practice or having held responsible positions and carried out important works at home. The candidate is selected by the Secretary of State for India on the recommendation of the President of the Royal Institute of British Architects. He comes out fully trained, and it is very essential that this should be so.

2,012. I attach hereto a schedule of conditions† handed to the Consulting Architect of Burma on his taking up his duties, and it will be seen therefrom that officially his services are called upon at the discretion of the engineer and then often only as a consultant after a scheme has been prepared by the engineer. It is a matter of constant occurrence for elaborate schemes to come up to the Consulting Architect for approval which are entirely wrong in conception, based, it may be, on a type plan applicable to an entirely different setting. By rejecting the scheme all the misdirected effort in its making is wasted, friction with the engineer perhaps arises and, as likely as not, a muddle results from part of the scheme having already been started. There are signs of improvement however in this respect as the Consulting Architect has proved to the various departments, such as the Medical and Educational, that it is to their advantage to consult him in the first instance, and make the fullest use of him, and this tendency, I am glad to say, is encouraged by the engineers.

2,013. But even in cases where the Consulting Architect is consulted in the first instance, and plans and estimates are prepared by him, his designs are carried out by the engineer, who is recruited at a very much younger age and whose experience in building and building methods is founded on what he learns in the East where admittedly the standard is very low. Examples of good brickwork, masonry, carpentry, plastering and plumbing are almost unknown to Burma. The result is that practically all government buildings lack that quality of finish essential to a good building. Attention to this point alone would, in my opinion, save government a large sum annually in repairs. An approximate estimate of repairs over years 1906-1907 to 1911-12 amounts to over Rs. 76½ lakhs.

2,014. The present system is that certain schemes drift into the Consulting Architect's office. I use the word "drift" because there is no definite ruling as to

whether the Executive Engineer or the Consulting Architect should prepare the plans of certain buildings. Often, as I have already remarked, an elaborate plan has been drawn up, having on it previous initials of approval. In the event of the Consulting Architect refusing to pass it one of two things must happen at the discretion of the engineer: (1) the scheme is scrapped and particulars are sent to the Consulting Architect to prepare a fresh one, a course at times apt to cause irritation and certainly delay, or (2) the work is proceeded with as it stands. If the former course is taken the Consulting Architect prepares full working drawings, and sends them back to the engineer to build. The latter is responsible for the construction of the building, a reference to the Architect is purely optional, and changes in the construction may be made without reference to the Architect though the latter must have gone into the question of construction fully at the time of designing, for no design is good unless constructionally sound. The engineer may employ a contractor to carry out the work, in fact he generally does in the larger centres. In such cases he has to see to the execution of designs which are not his own, and the detail of which he may not understand. Thus the Architect is unable to give government the fruit of his years of practical experience, and is cut off completely from the executive side of his profession where that experience ought to ensure good work and economy. This system is bad for the Architect also, who becomes merely a designer and theorist, and by degrees tends to lose touch with the practical side of his profession.

2,015. Before giving my summary of reforms I should like to refer to a pressing need in Burma, and I think the East generally, viz., the training of workmen. At Insein, government has a school under a very able and enthusiastic principal, Mr. Morris, with whom I have discussed this subject. He tells me that the scope of the school can easily be extended to training men in the building trades. In order to do so, it will be necessary to bring out some of our home working foremen who, by practical example, could demonstrate the best methods in the several trades and stimulate a pride in the quality of work, which I feel sure is only latent in the Oriental. I am constantly told that decent work cannot be expected from local labour. This is correct as things are, for the workman at present has no chance of learning. Only recently I took my coat off and did some brick-laying to show the workmen what I desired done. I was struck with the quickness with which they grasped what was wanted and the improvement in the work was obvious. Given decent training and attention the Oriental, whether Chinaman, Burman or Indian, could be made as good and conscientious a workman as any in the world.

2,016. I now come to the reforms which I suggest should be initiated as early as possible.

(1). (a). The Roads and Buildings Branch of the Public Works Department should be divided, the former remaining under the control of the engineer, the latter to be entirely in the hands of the Architect, who should be made responsible for not only design but also construction.

(b). The Government Architect should be given a necessary number of fully trained and qualified Architects as assistants. They might be recruited as at present, but brought out on pay corresponding to that of engineers of the same age. They might with advantage serve a two year term on probation, but on confirmation should be pensionable and subject to the same leave rules as engineers.

(c). The Government Architect should also have the assistance of a staff of native draftsmen who would not necessarily be permanent for reasons which I can give if required.

(d). One or more quantity surveyors should be brought out from home and paid as Architects.

(e). Clerks of works should be brought out from home to take the place of the subordinate or Assistant Engineer in daily supervision of the work. They would be directly responsible to the Architect, need not be pensionable, and could certainly be induced to come out on a salary of Rs. 350-400 a month.

* I append hereto a Table (not printed) giving the expenditure on buildings in Burma during the past 10 years, these figures are taken from the schedules of revenue and expenditure.

† Not printed.

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[Continued.]

(f). Certain working foremen should be brought out on terms similar to the clerk of works to instruct in the schools.

(2). All work costing over a lakh and important work costing less should be carried out by the Government Architects. Other works should be given whenever possible to private architects, whose designs and estimates should be approved by the Government Architect.

(3). In course of time, if it were found more suitable to divide the province into districts, one of the Assistant Architects could be assigned to each of the same, but he should remain responsible to the Government Architect as if he were working at headquarters.

(4). Each province should have attached to it one or more scholarships, which would entitle the recipient to study architecture in Europe and become duly qualified.

Mr. T. O. FOSTER called and examined.

2,918. (President.) The witness stated that he was the Consulting Architect to the Government of Burma and that he had held that post for a little over a year. Previous to this he had served in India for a period of two years and had spent part of such time under the Consulting Architect to the Government of India, and part in connection with the New Delhi Project. He had been recruited from England in the first instance, on an extendible two years' agreement, after the expiry of which his services had been retained. Since his transfer to Burma, however, he had signed a fresh agreement for a period of five years. He was a Fellow of the Royal Institute of British Architects.

2,919. Under the existing rules governing his appointment the Public Works Department decided whether his services should be utilized in preparing the design for any particular building, but on principle he was of opinion that an architect, not necessarily the Government architect, should design all buildings, including such as were small and unimportant. He desired to prepare the designs for all government buildings, but as this would not be feasible in actual practice he suggested that the designs for the small and unimportant government buildings might at least be passed by him. His ability to undertake all designs would depend to a large extent on the size of the staff placed at his disposal. In his opinion even standard designs in Burma should be prepared by an architect, because certain of such designs had been prepared in the past without due regard to their site. He did not think it was feasible to prepare a standard design to suit every building site and held that each case should be considered separately. It was possible, however, to do so with certain classes of buildings and he himself had prepared a standard unit for schools. He was of opinion that the plans for any particular building it was proposed to erect according to a standard design prepared by an architect should be scrutinised by an architect, as he knew of cases where an architect had been obliged to prepare a standard plan for a set of buildings although he would personally have preferred to treat each case separately. It was desirable that the designs for even small unimportant buildings in out-of-the-way places, where no local architect was available, should be prepared by an architect at headquarters, and he met the contention that the architect would be at a considerable disadvantage under such conditions owing to lack of local knowledge of the site, building materials and conditions of labour, etc., available, with the remark that such information could either be obtained from the local engineers or gleaned from a personal inspection of the site.

2,920. Architects in addition to being held responsible for the designs of buildings should also be made responsible for their construction. It would undoubtedly be of advantage, since the Rangoon Division was at present practically purely a buildings one, if a start were made by the transfer of this division to the executive control of the Government Architect. Owing to the lack of building work in other centres he knew of no other town that could be similarly treated at present. If

He then should be encouraged to practice in his district by giving him, if competent, minor government works.

(5). Each province should have schools or classes of instruction in the building trades, and selected men from the same could become clerks of works or instructors.

(6). Attention should be paid to the manufacture of building materials in Burma, especially brickmaking. It would in my opinion pay government handsomely to obtain the services of a specialist in brickmaking and the proper mixing of clays.

2,917. In conclusion I want it to be clearly understood that my foregoing remarks are directly solely against the present system and are in no way personal to the engineer. With one and all I have had occasion to meet, I have had the pleasantest relations and I have found them at all times most helpful and friendly to a marked degree.

architectural divisions were established in Burma it would be necessary to recruit qualified Assistant Architects from England, but their number would depend on the quantity of building work available in the province. On a review of the work it was proposed to undertake in the future, he anticipated that when it was in progress he would require at least four fully qualified Assistants, who were Associates of the Royal Institute of British Architects. The establishment he would require for carrying on the work of the Rangoon Division as an architectural division would be a qualified European Assistant Architect who would take the place of the Executive Engineer, his present drawing office establishment which included tracers, and two or three clerks to attend to letters and other office work, and a certain number of clerks of works to be recruited, in the first instance, from England. The services of a recognised qualified firm of quantity surveyors would also be requisitioned for the taking out of quantities from the architect's drawings. In addition he favoured the employment of English master workmen for the training of indigenous agency. He did not think the European agency he desired would make his scheme expensive at the commencement as he anticipated he would be able to carry out work with a lesser number of subordinates, and he stated he was able to prove his statement by figures. For this purpose he proposed to take the cost of works at present carried out in the province at Rs. 24 lakhs a year. To the contention that this figure applied to the whole of Burma he replied that when the works contemplated in Rangoon were in full swing the expenditure on them alone would amount to more than Rs. 24 lakhs and that there was, besides, every likelihood of additional work being required in Burma and especially in Rangoon, in the near future, e.g., the University building, the designs of which he had been asked to prepare. One clerk of works would be sufficient to supervise the construction of the average building and his salary plus the Architect's office establishment was all that need be set against the present 24½ per cent. which the Public Works Department stated the construction of the building would cost them.

2,921. Judging from the standard of workmanship in government buildings which had already been constructed, he did not think that the present Public Works Department subordinate staff was fully competent; in other words, that the class of work already executed by the Public Works Department had been sufficiently good. It was for this reason that he considered it essential that a staff of clerks of works should be employed in the architectural division, if it were formed, to ensure competent supervision. The employment of competent men to supervise construction would simplify the work of an architect a great deal. He did not think that his scheme suffered from the drawback that it involved the replacement of indigenous by European agency and remarked that from a financial point of view it compared favourably with the existing system. But he considered that trained subordinates of the Public

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Works Department might in course of time become fairly good clerks of works. The salary of the European clerks of works could be fixed at Rs. 350 to Rs. 400, but he was not in favour of making their appointments pensionable, as they would generally be recruited at an advanced age. He was convinced that it was possible to secure a satisfactory type of European on the salary he had proposed, as he had been in touch a great deal with foremen and clerks of works in England.

2,022. In respect to other parts of the province where buildings were scattered and were very often far from the railway, he suggested that the present organization of the Department might be retained for actual construction subject to the general control of the Architect who would be responsible for the structural stability of all buildings whether large or small.

2,023. It was desirable in the interests of private enterprise to make over, if possible, the designs of all unimportant buildings worth less than Rs. 1,00,000 to private architects, and to entrust the designs of all other buildings to the Government Architect, but all designs prepared by private architects should be approved by the Government Architect. He was aware of only one private architect in Rangoon who was a Fellow of the Royal Institute of British Architects, but he considered that the preparation of the designs for the smaller unimportant works should be open to all practising architects in Burma, since designs would under his proposal be subject to his approval. In his opinion, private architects would welcome the introduction of such a system and accept work of this nature with pleasure in spite of the fact that the actual construction of the buildings in the districts would remain in the hands of the local engineering staff. It might prove more economical if government increased its architectural staff to cope with all the designing work, but what he had in mind was the encouragement of the Burman architect and the creation of a desire in the Burmese community to study architecture. The sole idea of the Burman at present was to obtain government employment and he was given no encouragement in obtaining private work.

2,024. No arrangements were made in his office for the training of young Architects, and he only trained apprentice draughtsmen. One of these draughtsmen, was a young Burman. He was employed permanently but had not received any instruction in the theory of architecture. He had, however, received a certain amount of instruction in civil engineering and had opportunities in the office of acquiring whatever knowledge he could of the science of architecture. One student who was being trained in the Insein Engineering School had spent certain holidays in his office, and had received every encouragement. No system was in force in Burma under which subordinates of the Public Works Department who had shown a special aptitude for architecture could join the Architect's office and undergo a special course of training. He had given a lecture on architecture to the students of the Insein Engineering School, but did not think that a special course in architecture was included in the school curriculum. The results of an examination held by him of certain of the students had proved disappointing.

2,025. He suggested that young Burmans of means, who had displayed an aptitude for architecture might be given scholarships tenable in Europe to enable them to undergo a complete course, and that they should travel abroad in order to supplement their studies on completion of the course. He also suggested the recruitment of instructors in the several trades for the training of young Burmans in the composition of materials and their use, and considered it was possible to evolve an architect through such a channel of instruction. He mentioned in this connection that he knew of instances where European workmen who had evinced an aptitude for designing had in process of time become well known architects. It would also facilitate the development of trained workmen into architects if evening schools were in due course instituted. He was not aware, however,

whether any attempt had already been made to establish such classes in Burma, and repeated that the preliminary step necessary was to teach men the use of materials. This, in his opinion, was of greater importance than securing individual Burmans and giving them a training in architecture.

2,026. As the government rates varied a great deal it was difficult to effect a comparison between those rates and the rates of private firms, but he believed that the Public Works Department generally constructed buildings at rates below their scheduled rates. In one case the private rate for brickwork in the construction of a particular building was Rs. 60 as compared with Rs. 72 the rate estimated by government, but the class of material used by the private firm was inferior to the government material. His general opinion as an architect was that there was very little difference between the government and private rates. He could not therefore endorse the view that the private rates were 25 to 30 per cent. higher than the government rates. The cost of supervision was more in the case of government buildings than in that of private works, and had only amounted to 5 per cent. in the case of the private building he had referred to as compared with 25 per cent., the average Public Works Department supervision charge. The reason for this small percentage was that no clerk of works was engaged, but it included the architect's fees as that officer had supervised the construction. He here explained that whenever an architect supervised the construction of a building his fees were included in the supervision charges, and that if a clerk of works were found necessary the cost of his entertainment would be in addition to the 5 per cent., i. e., the architect's fees. He added that it was preferable if an owner did not undertake to supply the supervision and left it to the architect who could employ his own clerk of works, if necessary, though the cost of his entertainment would be met by the client.

2,027. From an examination of bricks manufactured by government and private agency he had concluded that the former were better inasmuch as better clay was used in their manufacture. He anticipated, however, that if private firms were paid a proper price for their bricks they would turn out the same class of brick as the Public Works Department. He believed the rate for first-class government bricks was Rs. 22. (Mr. Samuelson here stated that the price of first-class government bricks fluctuated between Rs. 18 and Rs. 20 per thousand). The witness then remarked that the rate was cheaper than the private rate but did not represent the actual cost. From an architectural point of view he thought it was desirable to encourage the manufacture of private bricks, and anticipated that private enterprise would be able to meet all demands for bricks if government closed their brickfield in Rangoon. He added that if he personally had to control the Rangoon Buildings Division as an architectural division, he would rely on the open market for his supply of bricks and would issue a standard specification indicating the class of brick required.

2,028. It was necessary for many future years to recruit Government Architects from England, and such men should be Associates of the Royal Institute of British Architects of 28 to 30 years of age and should have had practical architectural experience in England. A period of probation extending to two years would suffice in which to ascertain their suitability. He admitted on re-consideration, however, that a year's probation would be sufficient for the purpose. The posts of Government Architects, in his opinion, should be permanent short term appointments, extendible in cases in which men had worked satisfactorily. Such a course would be advantageous from the government point of view as a period of service in the East was liable to make men slack. This had in fact been his personal experience and he felt that his power of work had deteriorated since the day he had left England. He did not, however, agree with the contention that it was desirable to effect a change of Architects after a period of 5 or 7 years on the ground that Architects were apt to become wedded to

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particular styles of architecture and remarked that provided a man remained keen there was no doubt that with experience and long service in the country he would be better able to evolve suitable architecture for the country. Until such time as it was possible to secure a sufficient number of Architects to establish an association, where such officers might exchange views and thereby stimulate keenness, there was no remedy for the effect of the East on the keenness of Architects. He himself was at present isolated in Burma. Architects should in common fairness be recruited on the same basis and receive similar rates of pay to Public Works Department engineers. The Assistant Government Architects he had suggested should also be Associates of the Royal Institute of British Architects and between the ages of 28 and 30 and he did not think it would be advisable to recruit young Architects with very little practical experience for these posts.

2,929. (Sir Noel Kershner.) An Architect whose age was between 28 to 30 should receive a salary of Rs. 800 a month and a local allowance if posted to Burma and be entitled to a pension. He confirmed his contention that Architects could not be secured from England on short term agreements unless they were offered prospects of permanent employment. He admitted that there had been a surplus of architects in England prior to the war and that such men had found it difficult to earn a living, but did not think this would affect the recruitment of Architects in future in view of the fact that it had not affected the recruitment of engineers, which profession in his opinion had also been overstocked in England in normal times. He added that the same had been the case with most professions before the war and that Assistant Engineers were secured in England on the same rate of pay as Assistant Architects who generally received two to four pounds a week. He did not think that the proportion of qualified architects to qualified engineers whose services were available was greater, but admitted that the Royal Institute of British Architects made every endeavour to secure employment for their men, and remarked that in his own case he had been given hopes before appointment of obtaining permanent employment.

2,930. It was undoubtedly preferable that an architect should prepare the designs for small buildings instead of an engineer and the submission to the architect of photographs of the sites of buildings situated in out-of-the-way places would not meet the requirements as information regarding the surroundings, prevailing winds, the north point, etc., would also be necessary to enable an architect to design a work.

2,931. (Mr. Mackenzie.) Though it was desirable that an architect should possess personal knowledge of the local conditions of a building site in order to enable him properly to prepare a design for a particular building it would suffice if local engineers forwarded a written report to the Architect containing full information on the points on which information was desired. The fact that the rainfall in Burma varied enormously and that it ranged from 35 inches in Rangoon to 250 inches in certain other stations did not affect the position, since it was always possible to secure such statistics and allow for such variations. He adhered to his opinion that the Government Architect should be in touch with local conditions in all the districts in Burma, and remarked that this was why he had suggested that the Architect should be a controlling authority. It was true that it would take a long time to gain acquaintance with local conditions in all places, but the experience so gained would become more valuable with the flux of time.

2,932. The clerks of works he suggested might be transferred from one work to another, and their ignorance of local conditions would not be a great handicap to them as their work was of a supervisory character, as they were only employed to see that the Architect's drawings were carried out correctly and that the proper building materials were used.

2,933. He confirmed his suggestion that the Public Works Department might take over the construction of small government buildings in out-of-the-way places,

subject to the Government Architect assuming responsibility for their design and structural stability. He knew of buildings that had been erected exactly according to an architect's design and thought the buildings designed by him had been constructed without any modification in the designs.

2,934. If a technical question arose in a remote locality in connection with a building under construction it was desirable that the Architect, and not the local engineering staff, should decide the point in dispute, and that the Architect should visit the work whenever this was possible. His reason for this view was that he desired to retain the responsibility for work in his own hands and to hold an advisory position, and he knew of buildings at present under erection in the case of which he might have saved expense if he had possessed the authority he desired. He was prepared to assume the responsibility for the foundations as well as the structural steel details of a building, no matter how involved they were, provided he was accorded the option of utilizing the services of a trained specialist whenever necessary. In other words, he was prepared to assume the same responsibility as an architect in England. Though an architect in England engaged a contractor to erect a building, the former was held responsible for any mishap that might occur during its construction.

2,935. He had seen plans of buildings prepared by the Public Works Department which did not show the north point and had one such plan in his office. This experience was in no way unique.

2,936. He suggested the formation of a special committee to consider how the best brickwork could be secured.

2,937. The employment of quantity surveyors was in his opinion a necessity which should be encouraged. The duties of quantity surveyors were to work out the detailed quantities of a building, and these officers would replace the Public Works Department subordinates as they would in addition measure all work, including any extra work carried out by contractors. There was no objection to natives of India and Burma being trained in quantity surveying as he did not desire the permanent recruitment of quantity surveyors from England. He added that such men were at present almost unknown in India and that a contractor charged a percentage for extracting his own quantities.

2,938. He did not think the Public Works Department schedule of rates in Rangoon indicated that work had not been executed at those rates and remarked that if the schedule did not indicate the correct rates it would be altered. The schedule rates were regarded as confidential and were not intended for public use and they were only used as a guide. The estimated rates were generally known to contractors and higher rates were allowed in most cases in which they were exceeded. Hence though the Public Works Department would not admit it, they were at present absolutely in the hands of contractors, and it was because of this that he desired to constitute himself a buffer as it were between government and the contractors. There were probably some Public Works Department officers who kept themselves in touch with the market, but by the time an officer became a Superintending Engineer he was apt to become a little hazy over such points and a keen contractor generally knew the market rates better than a Superintending Engineer. All questions regarding contracts for works, as far as he was aware, were dealt with by the Superintending Engineer, as he had known of contracts for small works to have been discussed by the Executive Engineer with the Superintending Engineer. He anticipated that competition would keep down rates and remarked that Chinese contractors in Rangoon would cause keen competition to the detriment of the European contractor, as they would undertake work at rates less than those of the Public Works Department. But it was, of course, beneficial to government to get work executed as cheaply as possible. If he had to construct a building for government, he would throw the work open to competition as he would obtain a cheaper rate than was secured at present by this method.

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2,039. (*Mr. Cobb.*) It was possible that an engineer would be able to furnish information as to the differences between the Public Works Department schedule of rates and the rates at which buildings were actually constructed. The Rangoon General Hospital actually cost 12-06 annas a cubic foot. This was the bare cost of the buildings, exclusive of the cost of departmental supervision, and the corresponding cost according to the schedule of rates in use at the time was 8 or 9 annas a cubic foot. The estimated cost of this hospital was £560 a bed. The figure was admittedly very high, but it included the cost of the Out-Patient Department and all other departments in the hospital besides other items. The estimated rate for the main building was 10 annas a cubic foot, that for another portion 10-67 annas and 8 annas for a third portion. In England the cost per bed ranged between £100 and £1,000, but a figure between £500 and £700 was a representative one to select. Certain hospitals had been built in England for £900 per bed, but these were of an elaborate nature. As an instance of the variation of rates he cited the case of Government House, Rangoon, in which the rate worked out to 3-9 annas a cubic foot as compared with 12-06 annas a cubic foot in the case of the hospital, and added that the schedule of rates used in each of these two cases was approximately the same.

2,040. In connection with his suggestion that the actual construction of buildings might be entrusted to local engineers in remote places, he remarked that he was prepared to trust the engineers and their subordinates to execute works according to his designs and that he anticipated no difficulty in this respect. But he desired to reserve to himself the responsibility for whatever might happen, as he considered his control was essential.

2,041. He suggested that the four qualified Assistant Architects, whose employment he had previously recommended, should be recruited on a permanent basis. In spite of his contention that it would be to the advantage of government that there should occasionally be an infusion of new blood into the service, he did not approve of the suggestion that only two of these officers might be offered permanent appointments and the other two temporary appointments as he considered it unfair to offer Architects temporary employment.

2,042. When anything untoward occurred in a building in course of erection in England the architect was held responsible and the client could proceed against him in court. He himself on one occasion made good a sum of £10 owing to certain incorrect tiles having been used

on a building, and the contractor in this instance had succeeded in attributing the fault to him on the ground that he had not clearly specified the pattern of tiles that were to be used. He added that as things were at present an architect was in a helpless position if an engineer committed a fault during construction.

2,043. Both boys and men actually practising trades should be secured for the training he had suggested in the several building trades. It was true that it was a moot point whether actual working men could be induced to attend morning or evening classes, but it might be possible to induce them to join. The evening classes, he added, should be held in Rangoon in preference to Insein, and there was no objection to the inclusion of glazing among the subjects to be taught at the evening classes.

2,044. He considered the creation of a large government Architectural Department manned by permanent men would have a good effect on the development of indigenous architecture in Burma, and anticipated that such a department would expand in Burma as there were indications of the spread of architecture in the country. It was only proper that government should set an example by establishing a government department in the first instance and he anticipated that his scheme would not suffer from any drawback as Burmans could be trained to take the places of men recruited from England simultaneously with the working of the department. As the Burman school of architecture grew, private architects would gradually take up government work in the same manner as they had taken up work with the County Council and they could then be encouraged by being given small works to execute for a start.

2,045. (*Mr. Samuelson.*) The work of a quantity surveyor commenced after an architect had prepared the drawings, and consisted in estimating from those drawings the quantities of brickwork, wood-work, etc., that were necessary. After this was done the quantities were billed and were printed and circulated to the various contractors who were asked to tender. 2½ per cent. was the official percentage paid to a quantity surveyor for his work. Quantity surveying was a recognized profession in England where the quantity surveyor was considered a necessity.

2,046. Since seasoned timber was not available in Burma and was difficult to procure, he suggested that a certain sum of money should be set aside by the Stores Depot for the purchase of timber and having it cut to size and seasoned before sale to contractors. In his opinion, contractors would welcome the opportunity of being able to obtain seasoned timber.

G. V. CLARK, ESQ., PARTNER, MESSRS. CLARK AND GREIG, RANGOON.

Written Statement.

2,047. My experience of the system adopted for the execution of civil works relates principally to building work, my evidence will, therefore, be mainly confined to this subject. In my opinion, if building works were entirely separate from other works they would be carried out with greater economy, expedition and better results generally than under existing conditions.

2,048. Under the present system the actual cost of building works is increased by an establishment charge of some 20 per cent. In ordinary private practice both in England and the colonies the professional charges in connection with the carrying out of building projects do not ordinarily exceed 7½ per cent. on the cost of such works, which would include all cost of the design and professional supervision of the work, but not the salaries of expert supervisors or clerks of works as they are termed. But allowing for the salaries of such, what compares with the present establishment charges would not exceed 9 per cent. As previously stated the design and construction of building works should be an entirely separate branch of the Public Works Department and the officers of that Department should be engaged on building works and building works only, and should be recruited from men trained in the profession of architecture for gazetted officers and from men trained as practical

tradesmen for the subordinate staff who have charge of the supervision of building operations.

2,049. The preparation of estimates should be carried out under the direction and orders of the architects by men trained in the preparation of building estimates. At present only certain buildings are designed by Government Architects, but they appear to have nothing whatever to do with the construction of the buildings erected from their plans, and have no say in the preparation of the estimates. It consequently happens that estimates do not provide for items and details of construction the absence of which the architect would note, and during construction the trained and expert advice of the architect is absent from the many problems that construction gives rise to.

2,050. Under existing conditions, building works are supervised by a subordinate staff who are lacking in practical training and are consequently ignorant of and unfamiliar with the difficulties of practical construction. The efficiency of such a staff would enormously increase if a necessary qualification for appointment consisted of actual practical knowledge gained on work as a workman. Under English conditions, building works are directly supervised by men known as clerk of works, such men are in most cases recruited from foremen workmen, the foremen being men who

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have risen from workmen and been selected for this position by reason of their special capability.

2,951. The present Public Works Department system of supervision is bad in that it places in the hands of the subordinate staff a power of control over the actual building operations which they are not fitted for by reason of their unpractical training. One result is that the supervision instead of being directed towards economical and speedy construction consists generally of destructive criticism which very greatly hampers work. The general attitude of the subordinate staff in fact appears to be that their functions are to criticise and condemn work, and not, as they should be, to assist progress of works by their special knowledge.

2,952. This question of supervision of buildings is a very important one, and building supervision should only be exercised by thoroughly experienced men with a practical training on actual works, and not as at present by men without practical training in building work who are ignorant of actual construction and out of sympathy with the workmen, and consequently are not, as they should be, of assistance in the execution of work.

2,953. Regarding the question of the encouragement of private enterprise, my experience has been that it is entirely a question of individual officers but there is no general official tendency to encourage private enterprise. In the case of the Sanitary Department, the whole of the sanitary works are now being carried out departmentally which is the reverse of encouraging to private firms.

2,954. Broadly speaking, unless the fact is recognised that building design and execution is a specialized science demanding the services of trained specialists, and separated as such from general engineering, the execution

of building projects will continue to proceed under conditions which are neither as expeditious nor as economical nor yet as satisfactory in final results as they would be if projected and carried out on a system which was based on the recognition of that fact.

2,955. In contemplating the possibility of such a change regard should be had to the existence of qualified architects in private practice, whose services could be availed of, and such a change need not of necessity entail the formation of a large architectural department, the idea being that a government architectural department would generally control building projects, which could be carried out by any qualified architect. I would not suggest that large numbers of men be brought in from Europe to supervise works, but that trade schools or institutes be formed in which technical teaching would be carried out by a few such practical men.

2,956. In regard to the matter of encouragement to private enterprise, such encouragement should be largely determined by considerations as affecting the well-being of the workmen. A system of apprenticeship of workmen should be introduced with approved firms, and firms who employed skilled and qualified assistants, and employed and trained apprentices should be encouraged and assisted. Particular encouragement should be given to the training and employment of Burmese workmen, who at present do very little in the skilled building trades.

2,957. Under some such conditions building work would be greatly improved as regards standard of work, economy, and the time of execution, whilst the increased interest which an employer of labour would be encouraged to evince in his workmen would naturally result in an improvement in their condition which is desirable and important.

MR. G. V. CLARK called and examined.

2,958. (President.) The witness stated that he did not represent the Chamber of Commerce, and that he was a member of a firm of sanitary, plumbing and ordinary building contractors which undertook both government and private work. The firm employed a permanent staff consisting of three civil engineers and a few plumbers who were all recruited from England.

2,959. In his opinion, the supervisory charges of the Public Works Department were high, as they amounted to 20 per cent. as compared with 10 per cent. the amount it cost to construct a private building. He added that the results were also better in the latter case.

2,960. Two defects which he noticed in the contract system were the alteration of designs and the delay in making payments. Owing to the delay involved in both cases a contractor was obliged to increase his rates to protect himself from loss and he considered that the present procedure called for modification particularly in regard to the measurement of works. He added that a contractor was not confronted with the same difficulties in the construction of a private building, in which case it was easy to obtain payments and even advances if necessary, because of the absence of an elaborate system of measurements.

2,961. He did not agree with the contention expressed in evidence that private rates were 25 to 30 per cent. higher than the government rates. On the contrary he considered that the government rate was higher by at least 5 per cent. and he personally would be prepared to undertake private work at 5 per cent. less than the government rate. The view he had expressed was based on actual experience of the construction of both government and private buildings.

2,962. He considered that the subordinate staff of the Public Works Department was not sufficiently qualified and advocated the employment of master craftsmen in their stead. He added that as such men were not available in Burma they might be recruited from England to train the present subordinates.

2,963. His subordinate staff was recruited from students of the Insein School of Engineering. The theoretical training of the students of this school was satisfactory,

but their practical training was deficient. He therefore advocated a course of two years, practical training at the close of the theoretical training, and anticipated that private firms would be prepared to lend government their co-operation in the matter by undertaking the practical training of students free of charge.

2,964. His staff consisted chiefly of Indians and Chinamen and he employed only one or two Burmans in the plumbing line. The Burman generally was of indolent habits and he could not say why Burmans did not take to building work.

2,965. He did not agree that the Public Works Department were obliged to split up contracts owing to their inability to procure contractors who were capable of undertaking both the wood and masonry work in a building. In addition to Rangoon he had had experience of work in Akyab and other stations in Burma, and he had found that the better class of Chinese contractors tendered for both wood-work and masonry.

2,966. Tenders were called for by advertisement in the local newspapers and contractors thus had the opportunity of tendering for works.

2,967. He confirmed the remark in his written statement that the general tendency was to discourage private enterprise and stated that the question depended entirely on the personality of the officer in charge of a circle. Formerly, his firm obtained a great deal of government plumbing work and had incurred a large expenditure in recruiting plumbers from England, but they had recently been informed that as their rates for sanitary work were excessive such work would in future be executed departmentally. These rates he explained were however necessarily high, as one of the conditions was that a whole-time European plumber should be employed on sanitary works, and such a stipulation had been made in the case of the Customs House building. The plumbing work in that instance cost Rs. 30,000 approximately, and the firm had employed a whole-time European plumber on it for a period of 15 months.

2,968. He considered that the necessity for the government brickfield had been justified in the past and that the brickfield should continue to be maintained for the

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duration of the war. He considered, however, that it should be abolished at the close of the war as private enterprise was now manufacturing bricks as good as those of the Public Works Department and the private supply was sufficient for the requirements of government.

2,969. In his opinion the local market would be able to cope with the demand, if government purchased its stores including plumbing materials, locally, and he advocated that government should declare its intention of doing so one or two years in advance so as to enable firms to regulate their indents accordingly. The local rates for European stores were not cheap, but this was largely due to interest on the cost of stores kept in stock not being taken into consideration when comparing the cost of an article imported from England by the Public Works Department with its price when purchased locally. As there were two European firms of sanitary engineers in Rangoon besides some Indian firms, which were capable of supplying the sanitary fittings required by government, there would be keen competition.

2,970. His firm did not undertake water-works or drainage schemes. They only did plumbing work or work connected with septic tanks. He was not aware of the water-works schemes to which the Sanitary Engineer had referred and had only heard of one in the case of which tenders had probably not been invited, and for which his firm had not tendered.

2,971. The remarks in his written statement with regard to the apprenticing of workmen with approved firms referred particularly to Burmese craftsmen. Burmans took readily to plumbing work, and if the apprentice system were introduced he anticipated they would benefit materially by it. He was of opinion, however, that apprentices should be given a living wage and added that his firm did not employ apprentices but only paid hands. He approved of the suggestion for the recruitment of a limited number of master workmen for the purpose of giving a practical training to the Burmese craftsmen and their attachment to the Insein School of Engineering. He thought that private firms would greatly benefit if such a step were taken and that they would be willing to engage men who had received such a training. The standard of the building trades in Rangoon was low and there was an absence of finish in work, but he could not say how it compared with the standard of work in India.

2,972. He disapproved of the employment by government of a special plumbing establishment and considered that it appreciably affected private enterprise. He added that government employed its own establish-

ments for the plumbing work in Government House and the Rangoon General Hospital, and that such work could more suitably be entrusted to private firms which were competent to take over its maintenance.

2,973. The quantity of government sanitary work was at present greater than that obtainable from private sources. This was largely due to the war and ordinarily private sanitary work was heavier, though government had more maintenance work owing to only a small portion of the city being drained. In any case, the government work largely influenced the trade.

2,974. His firm employed three practical plumbers who had been recruited from England, one of whom was a foreman plumber. These men had proved satisfactory, and had been engaged on three years' agreements, without any promise of renewal. The cost to government of master workmen would be anything between Rs. 300 to 600 a month, with free passages from and to England.

2,975. (Mr. Cobb.) The plumbers who had been recruited from England generally gave satisfaction, but it was rather difficult to induce them to stay in the country because of their social inequality.

2,976. The Public Works Department could purchase a great deal of stores locally, and there was sufficient competition to keep down the prices. One of the reasons why the Public Works Department obtained their materials cheaper was that they did not pay duty and insurance charges. It was hardly fair to expect firms to keep articles in stock only for occasional purchases by the Public Works Department. If, however, the Public Works Department agreed to purchase all their stores locally the firms would no doubt be willing to stock the necessary stores. He did not anticipate that any firm would be prepared to supply imported articles to government at the rates quoted by the Director General of Stores, nor for an additional 10 per cent., but considered that firms would be only too glad to supply stores at 10 per cent. over and above the prices at which they themselves could import articles from England, provided such supply covered all the requirements of government.

2,977. (Mr. Samuelson.) The Public Works Department had just carried out sanitary work departmentally, in the case of the new Telegraph Office at Rangoon. His firm had not done any work in connection with the General Hospital, and he was not aware whether the present government plumbing staff grew out of the establishment employed on the construction of the General Hospital. (Mr. Samuelson here stated that such was the case.)

MAYNG BA, ASSESSOR, INCOME TAX, MANDALAY.

Written Statement.

2,978. (I.) Economy and suitability of methods of execution of public works.—I think the present methods adopted for the execution of civil works are not cheap. Even if the work is to be done by the local bodies on the same plans as are adopted by the Public Works Department the cost will be the same. But if the local bodies follow better methods, the works can no doubt be done quicker and more cheaply.

2,979. (II.) Encouragement of other agency.—In Upper Burma there are not many private agencies who can undertake any big or complicated work and except in places where there are such bodies only ordinary work easily understood should be entrusted to private bodies. I mean by local or private bodies—municipalities, town committees, and district boards, etc., Private enterprise at present is not much encouraged, and the encouragement should gradually be extended.

2,980. (IV.) Relations with other departments and sub-branches.—On inquiry I find that some departments of the administration do not fully approve of Public Works Department methods.

2,981. (VII.) Education, and (VIII.) Practical training.—The pay of the subordinates in the Public Works Department who undergo a course of study for over three years in the Engineering School, Insein, or anywhere else,

is not at present very attractive. Their pay should be increased to ensure the admission of more suitable youths and keep them above temptation. About one-third of the time spent by the students in the engineering school should be devoted to practical training by sending them on practical works in the province. I am of opinion that more practical training is wanted for the overseers and sub-overseers as well as the workmen. The Government Engineering School, Insein, may be enlarged, and one such school should be established in Mandalay also which will bring more men of Upper Burma into touch with the Public Works. Workmen also should receive training in these schools.

(2.) A sub-overseer trained in the Insein school is not considered useful to a private firm unless he acquires practical knowledge before joining. I understand that there are certain classes of officers on the temporary establishment who are never taken on the permanent establishment. There are disadvantages both to the Department and to men under the present system of keeping men on for a considerable time on temporary service. In my opinion, these men when they have fully proved their ability should be taken on the permanent establishment after a certain time, and should be allowed to draw a pension, the service counting from their first joining the service. This will I think encourage good men to join the service.

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MAUNG BA.

[Continued.]

MAUNG BA, called and examined.

2,982. (President.) The witness stated that he was the Assessor of Income Tax in Mandalay, and that though he had had experience of contractors he was not connected with the Public Works Department.

2,983. As far as he was aware there were no firms of contractors in Mandalay which were capable of undertaking the construction of important buildings.

2,984. He advocated that government might encourage private enterprise by purchasing bricks of local manufacture, and mentioned that as the Railway had done so there was no reason why the Public Works Department should not do the same. There was a government tile factory in Mandalay from which the Public Works Department at present obtained its supplies of bricks and tiles, and he considered that if government closed it down private people would take to manufacturing these articles.

2,985. There were very few Burmans in the Public Works Department, and nearly all those who were so employed held lower subordinate appointments. The entry of Burmans into the Department had, he considered, been largely influenced by the personality of the headmaster of the Insein Engineering School. The present headmaster had made himself popular, and it had only been during his tenure of office that Burmans had freely joined the engineering school. He added that the reasons why Burmans had not taken to engineering earlier was that the previous headmasters of the Insein school were unable to explain the advantages of the profession to Burmans and also that the school had not been given sufficient prominence in the past.

2,986. Most of the petty contractors at present in Burma were retired officers and subordinates of the Public Works Department and nearly all of them were Indians, since Burmans had not till very recently taken to contracting. He anticipated, however, that a large number of Burmans would take to contracting in course of time as the work was remunerative.

2,987. He considered that Burmans did not object to manual labour, as many of them were carpenters.

2,988. Formerly all buildings in Burma were made of wood, but several brick buildings had recently been erected in Mandalay both by government and private individuals.

2,989. The scale of pay for Public Works Department subordinates was Rs. 30 to Rs. 100 a month, but he had learnt from personal inquiries in Mandalay that subordinates actually received salaries ranging from Rs. 30 to Rs. 75 a month and were never paid Rs. 100. In his opinion this scale was not sufficiently attractive to a man who had received a three years' training in engineering. He admitted that the scale might be sufficient to attract Indians, but remarked that Burma was a more

expensive country and Indians besides came to Burma to make money. Prior to the submission of his written evidence he had consulted the head of the Public Works Department in Mandalay, various contractors and the head of a mission and ascertained that occasionally sub-overseers in receipt of a salary of Rs. 30 a month were required to control foremen of works who were paid Rs. 75 a month and considered the position was obviously anomalous. On the whole he was inclined to the view that the scale of pay for lower subordinates was too small to ensure honesty and that it was not even a living wage. For these reasons, and as hospital assistants after undergoing a three years' training received Rs. 50 to Rs. 100, he recommended the grant of a higher rate of pay.

2,990. (Sir Noel Kershaw.) Provided unreasonable rates of salary were not demanded, he stated it was desirable to employ Burmans in Burma in preference to Indians, and even to pay them higher rates in order to induce them to become lower subordinates.

2,991. There were a few Burman upper subordinates in the Public Works Department, and he knew of some who were stationed in Mandalay and of another who was at Nyaungu.

2,992. He was not aware how many Burmans were employed as officers in the Public Works Department, but knew of one who had qualified as an engineer in England and was at present employed as an Assistant Engineer in the Pegu Division. There were no Burman engineers in private firms, as Burmans had only very recently taken to the profession and preferred government service to private employment.

2,993. The large pagodas in Burma had been erected by Burmans, but the men who constructed them were not regarded among their community as engineers. They belonged to an hereditary class of bricklayers, and Indians were never engaged to construct pagodas or monasteries. Such men did not take up contracting work as they were not financially competent to do so. They preferred besides to take up job work to regular contracts as they did not like to be troubled with estimates. No plan or estimate was required for the erection of a pagoda or monastery, and when a private individual needed a house all he did was to employ bricklayers and supply them with a sketch of the building and the materials. Owners of private houses preferred to construct their dwellings by daily labour instead of by contract. (Mr. Samuelson here explained that the statement of the witness that subordinates started on Rs. 30 only was not correct, as these subordinates received in addition Rs. 20 as a Burma allowance. To this the witness replied that he had obtained his information from a pamphlet in which the scales of pay were shown.)

T. GIBSON ESQ., MESSRS. C. R. COWIE AND CO., RANGOON.

MR. T. GIBSON called and examined.

2,994. (President.) The witness stated that he had attended not as a representative, but merely as a member of the Burma Chamber of Commerce, and requested that his views be treated as personal.

2,995. His firm were importers and dealers in machinery, metals and articles of hardware, and only undertook petty repairs. They were connected with the Public Works Department in that they supplied that Department with materials and stores.

2,996. He suggested the freer purchase locally of European stores and considered a concession in this direction would induce local firms to stock a larger and better supply of materials. The Stores Department in Rangoon imported English stores, including cement and metal work, to the extent of between Rs. 4 and 5 lakhs annually, and though this amount was not considerable it would form an important factor. He did not agree that the Public Works Department could obtain stores cheaper by direct indent than by purchas-

ing them locally. On the contrary he thought that the reverse was sometimes the case, and that if government apprised local firms of their requirements they would be able to supply stores at cheaper rates than those at which they were obtained at present. Firms were quite cognisant of the fact that the Public Works Department only purchased stores from them when they ran out of stock, hence they based their charges accordingly. As a matter of fact it was the practice for the Department to make inquiries of local suppliers as to the rates for particular articles they required, and to accept the lowest quotation received. Consequently if an article which was required happened to be scarce and such article was stocked only by one firm, the Department had to pay more for it than they would have had to if a number of firms kept it in stock. The prices of articles were regulated by the demand.

2,997. Four or five firms in Rangoon were in a position to furnish quotations for raw materials such as bars

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MR. T. GIBSON.

[Continued.]

bolts and angles. He did not anticipate that if the present practice of obtaining stores direct from England through the Secretary of State were abandoned it would lead to a combination on the part of firms with the object of enhancing the rates for materials, as competition between them was too keen to admit of it, and they would stock a larger supply of materials for the use of the Public Works Department. In his opinion, if the annual indent which was despatched to the Secretary of State were made over to firms for compliance, they would probably be able to supply the materials at 20 per cent. less than the rates at which they were ordinarily obtainable by government and with greater expedition.

2,998. He recommended that local importing firms might be asked to furnish quotations for materials required for Public Works Department work, and thought such a procedure would encourage both importing and engineering firms, in that they would thus have the opportunity of tendering for articles of Indian and English manufacture. If government definitely announced their intention of obtaining certain articles in India it would certainly result in the establishment in Rangoon of works for their manufacture.

2,999. His firm supplied the Public Works Department with a considerable quantity of stores, in fact they had direct dealings with several Executive Engineers. But the rule under which these officers could only purchase from the firm such articles as were not in stock required modification.

F. DUKOFF GORDON, Esq., Accountant-General, Burma.

Written Statement.

(N. B.—The views expressed in this note are purely personal and are in way those of the Accounts Department.)

3,004. Prohibition against making payments during the last days of the month.—I am not aware of there being any such rule. It is a pity the particular province concerned was not mentioned. The ordinary rule is that payments should be made as soon as they fall due and if they fall due at the end of a month there is no reason why payment should not be made then. In fact a principle of account is that inevitable payments should be made promptly as soon as they are due. With the earlier closing of sub-divisional accounts it is understood that the officer will endeavour to make his payments promptly to secure the entry in the accounts of the current month, but if this cannot be done there is no prohibition against payment when it can be made. It is not clear how, even if the rule existed, it deprives contractors of funds at a time they are most needed. Contractors' claims are frequently delayed a few days for executive convenience and apparently no hardship is involved.

3,005. Early date prescribed for the submission of the monthly accounts.—This is an old complaint and it is not easy for the account office to combat it. Personally, I do not think that the submission of the accounts by the 10th of the month imposes any undue strain on the executive. If work is kept current and the accounts and registers posted as transactions occur it should be an easy matter to close the accounts in time. The nature of the executive work which is interfered with is not quite clear. The accountant and his staff are the men most concerned with the accounts and the accountant can on occasion sign the accounts himself. The incorporation of the sub-divisional accounts does take up a considerable portion of the first few days, but I do not think there is any real difficulty. Any change is burdensome to start with and if a genuine endeavour is made to close the month's account with despatch I do not think it will involve any undue inconvenience.

3,006. Prohibition against making advances to contractors.—The Code discourages advances and as a general system I am of opinion that the paying out of money when no value is received is not sound in principle. It can ordinarily be necessary only where the contractors are not substantial men and the risk in such a case

3,000. Cement could be tested in Rangoon without any difficulty, but that obtained from Europe was invariably accompanied by a test certificate. Most of the iron and steel materials were likewise tested by the manufacturers before they were shipped, and steel materials were practically all manufactured by firms who were on the Admiralty list in England. He did not think that government gained appreciably by having all their materials tested in England.

3,001. His experience in connection with the local purchase of stores was confined to the supply of materials to the Public Works Department, both through the local Stores Department and to Executive Engineers direct. He had had no connection with building contracts.

3,002. (Mr. Samuelson.) His firm were not actually supplied with test certificates for the iron bars they imported, but a considerable quantity of the bars was purchased from the Lanarkshire Steel Company who did their own testing and guaranteed a certain standard of strength. He did not think that if his firm were required to give a guarantee for the iron bars they supplied it would lead to increased rates because once they knew the requirements they could specify them in their indents and obtain the necessary guarantee from the manufacturer. The Scotch steel bars imported by his firm at present were of a standard specification, but formerly a large percentage of the bars were imported from Belgium and were not of the same quality.

3,003. (President.) His firm sold only the Associated Brand of cement which they imported from England.

would be material. Under the present rules a contractor can get a substantial payment on-account for materials at site or work actually done and this should be ample for most cases. Audit is not, however, responsible for the rule and can only see that it is observed. I do not, however, think that a recognized system of advances would be an advantage.

3,007. Excessiveness of audit objections.—Here again the accounts and the executive will probably never agree. Any spending authority will on occasion chafe at restraint imposed by rules and orders. But as long as government requires work to be carried out under certain financial conditions and limitations there will always be ground for objection. I admit that when dealing with a large system of accounts there is always fear of unnecessary and interfering objections, but in every account office there are frequent reviews and checks whose object is to eliminate frivolous and unnecessary objections and I do think that in recent years an advance has been made in this direction. The difficulty is that Code rules and requirements are so frequently disregarded. From the executive point of view they may be harassing and vexatious rules, but the remedy is to get the rules altered. Till this is done they should be loyally accepted and followed. I am not in a position to say how far change of rules is called for.

3,008. Unsuitability of financial year.—It is really difficult to see how the date of the closing of the financial year is unsuitable. To whatever date this closing might be transferred I feel sure that similar objections would be taken to it. I think that if the accounts of most provinces were examined it will be found that payments rise abnormally in January, February and March and experience a sudden drop in April which is continued for some months. The amount of money spent is roughly an index of the quantity of work performed. If this is so then it is hard to see how the year ends in the middle of the working season when the payments in April and May are comparatively small. Might it not be that there is a confusion here with the point which follows and that working against an allotment is the real defect.

3,009. Changes in budget system.—I do not think the Public Works Department have realized the requirements of a budget system. They are impatient of any instructions and while professing to know nothing

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[Continued.]

of accounts they do not hesitate to criticize a system which they have never understood and make very little effort to follow. The budget system is really simple and if an Executive Engineer would cease his frantic efforts to spend his grant and continue through February to May his normal operations without special reference to his grants, I think the burden of his budget would largely disappear. Under the past and more or less present procedure there is an understanding that an allotment must be spent. An allotment is made to occupy too large a place. The intention is to warn an officer that he must not ask for more than he can spend, but the result has been to make him endeavour to spend all he asks for even if he is not able to do so efficiently. Mr. Tomkins has suggested a scheme by which the temptation of the allotment can be removed from the Executive Engineer and as will be seen from my note below, I think it is a plan that may be adopted with advantage. Three plans have been suggested by which the Executive Engineer could be relieved of all responsibility for his accounts. He would be responsible for payments and receipts, but the actual booking of the figures and the submission of the accounts would be removed from his hands.

The plans suggested are—

- (a) the divisional accounts should be compiled in a central audit office, rather than in the divisional office;
- (b) a separate Accounts Branch should be formed in each divisional office with an accounts officer in independent charge; and
- (c) a system of travelling audit should be introduced; the accounts being audited in the divisional, instead of the central office; and notes by Mr. J. S. Milne and Mr. H. G. Tomkins showing some aspects of these plans are attached.

3,010. *Compilation of divisional accounts in a central audit Office.*—I may say that personally I think it would be a mistake to remove the accounts work of his division from the Executive Engineer's control and I would favour the continuance of the present procedure, which might be made more accommodating in details and the accountant's position recognized. The plan suggested in (b) would approximate closely to the present situation and would give an Executive Engineer considerable relief, but in my opinion it would be a far too costly change and in time would probably cause very little less trouble than the present procedure. I feel strongly that if the Executive Engineer would interest himself in his accounts matters, he would find that after all he can work under the present system without undue inconvenience. To divorce him from his accounts

will be to weaken his sense of responsibility. I do think it helps him to realize his responsibility when he sees how far his work is in conformity to the rules and how his work stands financially.

3,011. (*General.*) Mr. Milne suggests that the Executive Engineers be only paying and receiving officers so far as money and accounts stand and that the accounts be compiled in the Superintending Engineer's office by an accounts staff under a chief accountant. If a change has to come I think this plan stands as good a chance as any. Being compiled in the office of the Superintending Engineer, a superior sanctioning authority and, if the suggestion of Mr. Tomkins that he be the authority entrusted with the budget allotment is adopted, one that can control the allotment, it is probably a more convenient plan than to have the accounts compiled in the accounts office. In Burma the accounts are compiled in the divisions and are sent up to the audit office in the form of an account current and there are 33 divisions. As Mr. Milne says his suggestion is at present only in general terms. It will involve many changes and will need to be examined from many points of view. I do not feel in a position to commend or reject it, as personally I prefer the present system, and there are so many details to consider in the proposed one.

(2). It would apparently be necessary to have two classes of local inspection, one for the divisional offices as reconstituted and the other for the new compiling offices.

(3). Mr. Tomkins' suggestion for the abolition of detailed allotments involves a radical change and at first sight seemed too drastic and one that weakened the budget system. The system is, however, recognized in a somewhat similar way where there are provincial instead of district grants in the Civil Department. I doubt if there would be any real loss of efficiency when the system was once established. I should like to see it given a chance. There would probably, for the first few years, be complaints that during the closing months of the year the Executive Engineers spent more than was expected, but when it is known that money would be available when wanted and if a table of averages for a circle were carefully worked out, I think the Executive Engineer's monthly progress reports to the Superintending Engineer and the Accountant-General's monthly circle reports would enable a Superintending Engineer to make adequate provision and surrender what would probably not be required.

(4). I regret that owing to this being a very busy time of the year I have not been able to examine the points in more detail.

MR. F. DUKOFF GORDON called and examined.

(N. B.—The views expressed are purely personal and are in no way those of the Accounts Department.)

3,012. (*President.*) The witness stated that he was Accountant-General, Burma, and that there was no objection from an accounts point of view to the abolition of the maintenance of sub-heads of account for petty works as the Public Works Department apparently did not derive any material benefit from the practice. The question, however, was purely an administrative one. Accounts were kept by sub-heads in Burma for minor works and the limit for the latter was Rs. 5,000. There was no accounts objection to the increase of the limit provided a qualified and trustworthy man was placed in charge of the work.

3,013. The monthly accounts in Burma were compiled in the divisional office, but he could not say on the spur of the moment how many forms these accounts comprised. The chief document was the account current and this was supported by a large number of schedules and schedule dockets. The number might be 20, or even more, but it depended entirely on the number of works under construction, the outlay on each of which was supported by a schedule docket. He did not agree with the view that the compilation of the monthly accounts absorbed a great deal of the Executive Engineer's time at

the beginning of each month and that it prejudiced his executive work, as the divisional accounts could without difficulty be submitted by the 10th of each month. When the Executive Engineer was on tour the accountant signed and submitted the accounts and the Executive Engineer checked them on his return to headquarters. In his opinion, it was inadvisable to divorce the Executive Engineer from his accounts work and to have the divisional accounts prepared in the central accounts office.

3,014. A large number of payments were made in Burma by sub-divisional officers whose accounts would not in many cases reach the divisional office till late. The divisional accounts had to be in the audit office by the 20th; within this date the dates could be altered to suit particular cases. The accounts were actually received in the audit office about the 26th or 27th. If the accounts were kept up-to-date there was no reason why they should not be completed within six or seven days. He was opposed to the accountant attached to the office of the Executive Engineer being made responsible for the compilation of his divisional accounts, as he considered that the Executive Engineer should be cognisant of how his accounts actually stood. Under the suggested procedure a conscientious executive officer

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[Continued.]

would probably maintain some form of accounts even if the divisional accounts were left to the accountant, but much would depend on the personality of the officers; there were some officers who were very particular regarding their accounts and there were others, on the other hand, who evinced no interest in their accounts.

3,015. He had read the evidence of Mr. Tomkins, Accountant-General, Bengal, who had abolished most of the forms submitted with the monthly accounts and reduced their number to three or four, and had introduced a system under which the monthly compilation of accounts was carried out in the office of the Accountant-General instead of in that of the Executive Engineer, but he was not convinced that the system was advantageous as it did not enable an Executive Engineer to have a proper knowledge of the state of his accounts. What he gathered from Mr. Tomkins' note was that the accounts submitted by Executive Engineers in Bengal merely consisted of vouchers, so that the Executive Engineer did not have the opportunity of seeing the booked figures. Hence he presumed that Executive Engineers had to maintain work abstracts similar to those maintained by sub-divisional officers in order to watch the progress of expenditure. He was unable to make his meaning clearer, but it was essential that the Executive Engineer should know the state of his accounts in order to regulate expenditure. There was really no objection to Mr. Tomkins' scheme from an accounts point of view and the objections he had urged were purely executive. The question was whether the simplified system gave an Executive Engineer sufficient information as to the progress of work. A very real danger in the system was that it enabled an Executive Engineer to act just as he pleased independently of accounts restrictions, and that there was no one to question his actions. He considered it would be a better plan, if the system were introduced, to make the Superintending Engineer's office the unit as that officer possessed larger powers of sanction.

3,016. He could not say definitely what percentage of expenditure in Burma was placed under audit objection as about 40 sets of accounts passed through his hands, but he thought it probably amounted to about 15 to 20 per cent.

3,017. He had been in Burma for 7 months and could not remember any cases of proved fraud having occurred in the Public Works Department during this period. A case was under consideration at present in which a contractor had been paid an advance which had been deducted in his final bill. The contractor had repudiated the advance, but he was not sure whether the case was one of actual fraud or oversight.

3,018. The complaint that a large number of petty objections were raised in audit applied equally to every large spending department and no large spending department could be immune in this respect. The same scrutiny could not be exercised when dealing with numerous transactions as when dealing with a small set of accounts. Objections were primarily raised by the auditor and approved by the accountant in charge of the audit section, but in some cases the accountant himself drew up the list of objections. The pay of an auditor ranged between Rs. 40 and Rs. 80 per month, and that of an accountant between Rs. 125 and Rs. 400. After the accountant had scrutinised the objections he passed them on to the branch officer who finally approved of their issue. The pay of the branch officer was Rs. 300 to Rs. 1,250 per mensem, and he was a member of the General List of the Accounts Department. No objections issued from an accounts office without their having first been scrutinised by a responsible accounts officer, who was required to affix his signature thereto in token of approval. He was not sure whether the branch officer actually read the entire list of objections which were in some instances very numerous, but the small lists could easily be perused.

3,019. A large number of the objections were due to the want of appropriations and this class of objection constituted one of the main items of objection. One point

in favour of Mr. Tomkins' proposals was the discontinuance of the allotment of funds to Executive Engineers, the grant for the circle remaining with the Superintending Engineer, as it enabled an Executive Engineer to incur expenditure without reference to particular allotments, subject to the control of the Superintending Engineer, and thus relieved the Executive Engineer of the temptation of working up to his budget grants. In his opinion, executive officers did not really understand the budget or regulate their grants properly, and the rule in the Code with regard to lapses had been interpreted to mean that the full allotment should be utilized, with the result that every effort was made to spend it. This policy was wrong in principle and all money that could not be spent profitably should be surrendered. Mr. Tomkins' proposals were somewhat opposed to the principle that all expenditure should be covered by an allotment, a principle upon which all government expenditure was based, and it was possible that if Executive Engineers were allowed a free hand in the matter of expenditure they would not spend money as cautiously as they did at present. For instance, under Mr. Tomkins' scheme, the Executive Engineer would perhaps construct works to suit his own convenience, or works which he would be able to complete quickly, allowing other works to proceed slowly until the Superintending Engineer noticed the irregularity. To obviate such a contingency it would perhaps be necessary to furnish the Superintending Engineer with a monthly progress report showing the progress of expenditure in each division and the circle as a whole to enable that officer to regulate the expenditure in his circle. A big responsibility would thus be thrown on the Superintending Engineer in the matter of budget check, but he was personally of the opinion that the scheme was workable and was disposed to regard it favourably. He added that he would like it given a trial though he could not guarantee that it would work satisfactorily.

3,020. He had had a great deal of experience in connection with travelling audit. The audit of the accounts of local bodies and municipalities was carried out once or twice a year and there was no reason why the same rules should not apply to the accounts of the Public Works Department.

3,021. He was opposed to the grant of advances to contractors as he considered the practice was unsound in principle. Contractors did not have much cause for complaint at the present time as they could always obtain payment on account in respect of work which had been partly completed and could also obtain advances on materials brought to site. He thought there was a rule in the Code which allowed for the payment of the value of materials delivered at site but he spoke subject to correction. If an estimate for a building allowed for a certain number of doors and windows in connection with the wood-work and the contractor brought the necessary wood to site but had not actually started the making of the doors and windows, he personally would have no objection to the payment of a percentage on such materials. He, therefore, saw no objection to an Executive Engineer making an intelligent estimate of the value of materials at site and paying for them.

3,022. No profit and loss account was maintained of the transactions of the Stores Depot in Rangoon and the Audit Department had not insisted on the maintenance of one. It would be of advantage if such an account were maintained as it would enable government to see whether the Stores Depot was being run economically or not.

3,023. There was a government brickfield in Rangoon but he was not aware* whether the Audit Department had ever ascertained whether the brickfield had been run on economical lines or not, as he had been in Rangoon only for a short time.

*The witness afterwards wrote that he understood the accounts had been carefully looked into and found satisfactory.

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[Continued.]

3,024. (*Sir Noel Kershaw.*) The rates in the Stores Depot were fixed half-yearly by the Executive Engineer with reference to the actual cost price of the stores. They thus varied, and the adjustment of rates did not show whether the stores were working at a profit or a loss.

3,025. On being told that an engineer had admitted that although he had to certify to the correctness of his accounts he very seldom had the opportunity to look through them and had thus to accept the work of his accounts staff on trust, he stated that the present system was a good one because, as he had previously stated, he would be very sorry to see the Executive Engineer divorced from his accounts.

3,026. He admitted that audit objections were often raised unnecessarily, but remarked that every endeavour was made to reduce their number. Many of the objections at present raised were due to officers not having the time to read the lists carefully and eliminate those that were unnecessary.

3,027. (*Mr. Mackenzie.*) He agreed that it was desirable that the Stores Depot in Rangoon should not be run at a loss, but stated that he was not familiar with its working. It was also desirable that rent and interest charges should be included in the capital account in order that that account should be a representative one, but it would probably be very difficult to calculate such charges in those years in which the purchase and importation of stores was heavy. A quinquennial check of the transactions would probably suffice, and a similar check could also be applied to the brickfields, account.

3,028. It would be wrong in principle as well as from an accounts point of view to inform a contractor, after giving him a contract for a particular work, that the allotment therefor had been reduced, as inevitable payments for work done should be made irrespective of the state of the allotment. As a matter of fact, Executive Engineers generally informed a contractor beforehand what allotment was made for a work in order to enable him to regulate his operations accordingly, and contractors naturally felt aggrieved if, towards the end of the year, they were informed that they could not be paid for the entire work executed by them. An Executive Engineer was judged in a large measure by the percentage of his expenditure compared with his grants and a large disparity between the two denoted that an officer was not able to regulate his budget grants properly. An allotment should represent what an Executive Engineer was able to spend in a particular year and no more, and his forecasts of expenditure should be made with due regard to this principle. As a matter of fact Executive Engineers received smaller grants than were actually required with the result that they were entirely spent without difficulty. His conclusion in the matter, therefore, was that grants should, as far

as possible, be regulated with reference to the actual expenditure and that it was entirely wrong in principle to defer payments to contractors because of an insufficiency of grants.

3,029. (*Mr. Cobb.*) The task of reducing the number of frivolous audit objections was almost a hopeless one and he had always made every effort in this direction and had dealt with the question as sympathetically as possible. The number of audit objections was not increasing and the only remedy was to employ a better paid class of men as auditors.

3,030. (*Mr. Samuelson.*) It was difficult to state whether any of the monthly accounts compiled in the divisional office were of value to Executive Engineers, but they were compiled from registers which were useful. (*Mr. Samuelson* here stated that he had never found a single one of any value).

3,031. (*President.*) The preliminary list of budget requirements was submitted about July or August and the final demands in October or November. The dates fixed for the submission of the provincial budget were, from the end of October to the middle of December and he received the estimates of receipts and expenditure of district officers and heads of departments about November. The first edition of the budget notes on the preliminary estimates was submitted about the 2nd of January and the final figures were incorporated in a telegram which was despatched on the 9th March.

3,032. He had no knowledge of the seasons for the crops in Burma except the information which he received when working out the land revenue from the estimates received at different times of the year showing how the crops were likely to turn out. He thought that the rice harvest was gathered in the month of December, but the Financial Commissioner was responsible for the forecast in this connection.

3,033. (*Sir Noel Kershaw.*) He agreed that the Executive Engineer should prepare* a profit and loss account in connection with the Stores Depot in Rangoon in a form drawn up by the Accounts Department, and stated that its drawing up should not present any difficulty.

*The witness afterwards wrote:— "I may explain that the Stores Depot of the Public Works Department is not run as a commercial venture but is purely for departmental convenience. The question of profit and loss would only arise when examining whether a suitable adjustment of rates was made half-yearly and to ascertain that works were being charged with the true prices of the articles used in consideration of the purchase price of stores obtained in a varying market. There can be no question of striving for a profit. The Stores Depot is a recognised system of service and the cost of establishment, rent, and such items is a provincial item and is not charged in the cost of the articles to the work served. To take all this into consideration in fixing the price to be charged would be to radically alter the present recognised system."

At Rangoon, Saturday, 10th March 1917.

PRESENT:

F. G. SLY, Esq., C.S.I., I.C.S. (*President*).

SIR NOEL KERSHAW, K.C.B.

A. T. MACKENZIE, Esq.

C. S. COBB, Esq., M.V.O.

And the following Co-opted Member:—

B. M. SAMUELSON, Esq., M.I.C.E., M.R.S.T., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (*Secretary*).

J. P. HARDIMAN, Esq., I.C.S., Deputy Commissioner, Burma.

Written Statement.

3,034. (*Qualifications.*) I feel diffidence in expressing my views on any of the matters concerned, since my

service has been for the most part in special departments or special appointments. The longest uninterrupted period during which I have been in charge of an ordinary

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MR. J. P. HARDMAN.

[Continued.]

district has been two years, from April 1912 to April 1914, when I was Deputy Commissioner of the Tavoy district. This, however, happened to be at a time when the question of the construction of roads to serve the mines in the Tavoy district was coming into prominence, owing to great activity in the search for tungsten.

3,035. (I.) Economy and suitability of methods of execution of public works.—So far as Burma is concerned, my opinion is that the methods at present adopted are generally suitable, but that some improvements in the organization of the Public Works Department are possible, and that these would remove delays, encourage co-operation between the Executive Engineer and the Deputy Commissioner, and make existing methods more suitable. This matter I will refer to later under headings (iv) and (v). As to the particular question whether existing methods are economical, I think that in Burma the limited extent of private enterprise makes it impracticable to substitute private for departmental agency on a scale much greater than at present. A radical change of system in Burma seems to be out of the question. I am however of opinion, and may note the fact here, that the existing system under which grants for public works lapse at the close of the current year is wasteful. My impression is that the rule about grants lapsing tends to the hurried expenditure of money in order to prevent it lapsing, and if a system can be devised under which the grants will not lapse, the work done will be more thoroughly done.

3,036. (II.) Encouragement of other agency.—I do not consider that there is much scope at present in Burma for the encouragement of private enterprise by the increased employment of private firms. The large firms of contractors operating in Burma are few in number, and my impression is that their rates are high, and competition not sufficient to make their rates low. I am not aware that a contract for the construction of a long length of public works road has ever been entrusted to a single local firm of contractors in Burma, and I doubt whether any of the firms operating at present would regard favourably an invitation so to contract. I believe that they contract mainly if not entirely for structures—buildings or bridges—not for roads, and that they are, as it is, fully utilized by the Department. Contracts for the erection of important public buildings are, I believe, always placed with private firms. Conditions will no doubt change as the province develops, but at present I cannot see there is much scope for the increased encouragement of private enterprise.

(2). As regards the employment of local bodies, in Rangoon and Mandalay only are there local bodies which employ skilled engineering staffs, namely, in Rangoon the Municipal Committee, the Port Trust, and the Town Lands Reclamation Fund; these staffs could not conveniently supervise public works outside Rangoon, and, within Rangoon, the Public Works Department controls, besides the large public buildings, only some short lengths of roads. It is possible that this road work might be given to the municipality to construct and maintain, but the change would not be an important one. In Mandalay the municipality employs a skilled engineering staff but it is small.

(3). The district cess and district funds are poor, and few if any could afford a skilled staff. The richest fund is the district cess fund of Hanthawaddy (Rs. 3,27,730 only).

(4). As regards contracting out for the upkeep of works, except in Rangoon where the few firms of large contractors have their headquarters, I doubt whether it would be possible to make arrangements with the original contractors to maintain the work.

3,037. (III.) Changes in organization.—There is a very general idea that the *personnel* of the engineer establishment of the Public Works Department is inferior now in technical and administrative capacity to what it was a few years back. I have been informed that the Secretary of State has found difficulty in recruiting a suitable class of officer. It seems to me that the remedy for this is to make the conditions of service in the Department more attractive. Better pay will bring better men.

Such a change would involve extra cost to the state but I think that, if the quality of the recruit were improved, economies in other directions would be found possible. The method which suggests itself to me is a measure of decentralization, to which I will refer under head (v).

3,038. (IV.) Relations with other departments and sub-branches.—I am of opinion that the Public Works Department in some respects does not meet the needs of the other departments of the administration, and therefore of the public, and that there is some unnecessary delay in formulating schemes of public works and in executing the same. I understand that before the execution of an important work receives technical sanction in the Public Works Department detailed estimates covering the work have to be drawn up by the Executive Engineer concerned, which estimates are scrutinised first by the Superintending Engineer, and finally in the Public Works Secretariat. If a better qualified body of recruits to the engineer establishment could be obtained, it might, I think, be possible to abolish the appointments of Superintending Engineer. The estimate would then after preparation by the Executive Engineer go direct to the Public Works Department Secretariat, thus avoiding the delay involved in intermediate check of the estimate. Technical sanction would be obtained at an earlier date, and there would be no greater risk of the detailed estimate being defective than there is at present, inasmuch as the original plan and estimate would have been prepared by a more highly qualified officer. The abolition of Superintending Engineers and their establishments would effect a saving, a portion of which might be diverted to improving the prospects of recruits to the Department, the other portion being spent on the provincial Road Board suggested against heading (v) below.

I am not competent to record an opinion as to the nature of the relations *inter se* of the various sub-divisions of the Buildings and Roads Branch.

3,039. (V.) Decentralization.—The abolition of the appointments of Superintending Engineers suggested in the last preceding paragraph, and the imposition of a more efficient check of estimates in the offices of Executive Engineers amount to a measure of decentralization. It is not, I think, necessary to hold that the staff of the central Secretariat at present employed on checking the estimates prepared by Executive and Superintending Engineers, would require to be strengthened. If the employment of a more highly paid and better qualified cadre of Executive Engineers makes the initial detailed estimate more accurate, the second check in the Secretariat need be no more laborious than at present.

(2). It would, however, probably be necessary to employ at the central Secretariat a Road Board, composed of senior officers of the Department, to carry out the local inspection at present performed by Superintending Engineers, and to co-ordinate projects for through means of communication from district to district. Their inspection, as at present the inspection made by a Superintending Engineer, would be carried out on the spot, not from the central office. The co-ordination of projects for through routes is, it is true, a measure of centralization, but here centralization is called for.

(3). A further question calls for examination at this point, namely, whether the existing procedure of sanction should be modified. I qualify my remarks by pointing to the short time for which I have been in executive charge of an ordinary district. The objection which is most commonly raised against the administration in Burma of the Public Works Department is that since the Deputy Commissioner and the Executive Engineer are, according to the existing rules*, co-ordinate authorities, the former, although the executive head of the district, has little power of supervision over or of interference in the district scheme of public works; that although the Deputy Commissioner may see faulty work being carried out in the Public Works Department, or

*Head VII Public Works Department of the *Rules for the conduct and disposal of official correspondence* (General Department Circular 77, of the 12th December 1908).

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[Continued.]

may notice omissions which require rectification, the channels of correspondence are protruded, and it takes a long time for him to bring his view officially to the notice of the modifying authority. The particular government rule objected to is, I think, sub-head (b) of the reference quoted in the footnote. The passage is as follows :—

"If the Executive Engineer takes exception to the Deputy Commissioner's views on any matter [regarding works in the district] he may refer it to the Superintending Engineer for orders."

In other words he need not refer it at all unless he likes and, if he does refer it, it must be to the superior authority in his own Department, and there is no machinery by which immediate cognizance can be taken by the Deputy Commissioner or by the Deputy Commissioner's superior authority, the Commissioner of the Division.

(4). I may say at once that the argument that the Deputy Commissioner, as the head of the district, ought to be placed in a position of control over the Public Works Department has to my mind no very strong foundation. It would to my mind be just as dangerous for a Deputy Commissioner to interfere with the technical execution of public works in his district as it would be, we may say, for him to dictate to the Civil Surgeon on the management of a hospital, or to the Deputy Conservator of Forests as to the upkeep of a working plan. It can hardly be said that the upkeep of a working plan for a forest reserve, or the management of a hospital are more technical than the construction of a bridge or the creation or maintenance of a main road. The argument that there would be less venality among the subordinates of the Public Works Department if they were under the Deputy Commissioner has, I think, no great weight. It is a common-places to say that the subordinate grades of the Public Works Department are venal, but I do not know that they are any more venal in Burma than elsewhere. I have no personal experience on the point, but I feel some doubt whether any class of Indian subordinate drawn from the same grade of society, paid the small wages which a Public Works Department subordinate receives, and subjected to the same opportunities and temptation, would not yield to them. It would undoubtedly attract a class of men not only technically better qualified but also less prone to questionable practices in regard to money if the subordinate staff could be paid better. As in the case of the officers recruited for the engineers' establishment, the question seems to me to be one of money. If government can pay for a better article it can get it, and if it will not pay then it will not get it. I can think of no easy means of improving the class of men in the lower grades of the Department, and so of relieving it from the charge that its subordinate establishments are dishonest. Nor do I think that to make the Executive Engineer directly subordinate to the Deputy Commissioner would add to the zeal or efficiency of the former. In the districts in which I have served it has seemed to me that the Executive Engineers were at least as zealous as the local heads of any other department. Certainly in Tavoy the ungrudging efforts of the Public Works Department to create roads in difficult country and with no labour force to speak of available did not to my mind obtain from the public the appreciation that they deserved. Looking to the technical nature of the operations of the Department I am decidedly of opinion that decentralization in the mode sometimes light heartedly suggested, i.e., by placing some or all of the public works of a district beneath the charge of the Deputy Commissioner, would be unwise and impracticable.

(5). The substance of the complaints against the Department lies to my mind in the fact that it is not readily responsive to public opinion. Where the Public Works Department differs from other technical departments of

government is that it touches the public more closely than they do, and is therefore more liable to public opinion. The public are directly interested in the creation and maintenance of a road scheme whereas they are shut out of a forest reserve. A larger volume of public opinion is concentrated on the method of execution of public works. It is, therefore, to my mind to be expected that criticism of the Public Works Department should be more frequently met with and more freely expressed than of some other departments, and I am of opinion that the consideration of and response to public opinion is less prompt than it should be. The Deputy Commissioner, as the representative of this public opinion in respect to public works, ought to be brought into closer touch with the Executive Engineer. As the rules stand at present, the closeness of touch that exists between these two officials depends entirely on the temperament of the two. If they are mutually conciliatory, then the Deputy Commissioner will be kept as closely in touch with the progress of public works in his district as he asks to be, and any suggestions that he may desire to make will, I think, receive as speedy attention from the Executive Engineer as the latter can give them. But the rules leave too much to the personal element and are therefore faulty, and should, I think, be revised so as to apply to all cases including the one in which the mutual relations are not, or are less, conciliatory. From what I have said above it follows that my opinion is that this object ought to be secured in some other way than by making the Executive Engineer the subordinate of the Deputy Commissioner. I would suggest some such modification of clause (b) quoted above, regulating the relations between the Executive Engineer and the Deputy Commissioner, as will ensure that the Deputy Commissioner is kept constantly informed of the progress of the public works in his district, e.g., by means of periodical progress reports (as is done at present in the case of public works carried out by the Public Works Department at the cost of a district or district cess fund). I would also suggest that the Executive Engineer and the Deputy Commissioner be encouraged to tour together wherever possible, and I would modify the last sentence of sub-clause (b) quoted above in such a way as to provide for any differences of opinion between the Executive Engineer and the Deputy Commissioner regarding the progress made with the public works of a district being forthwith brought to the notice of the Superintending Engineer and the Commissioner of the Division.

(6). These remarks refer to works in progress or to maintenance works. So far as regards proposals for the alteration of the road programme (sub-clause (a) of the circular quoted above) my experience in Tavoy was that the Deputy Commissioner was consulted freely, and had every opportunity of expressing his views, to which due attention was paid. I think, however, that it might tend to reduce delays in the preparation or revision of a scheme of roads if the scheme were prepared, not as the result of correspondence between the Deputy Commissioner, the Executive Engineer, the Commissioner, the Superintending Engineer and finally the Public Works Secretariat, but at a conference of these authorities. Procedure by conference and committee would I think tend to expedition in the construction of works, and to greater co-operation between the Executive Engineer and the Deputy Commissioner.

3,010. (VI.) *Simplification of procedure.*—I am not competent to express an opinion upon this matter.

3,011. (VII.) *Education.*—There is no government engineering college in Burma. There is a government school of engineering which has I believe during the past two years been doing admirable work in the education of mechanics and carpenters.

3,012. (VIII.) *Practical training.*—I am not aware that any provision is made for such students in Burma.

Mr. J. P. HARDIMAN called and examined.

3,013. (President.) The witness stated that he was a Deputy Commissioner in Burma, and that he had had

19 years' service. He was at present employed on special duty in Rangoon. His appointment before that

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[Continued.]

had been Collector of Rangoon and this brought him into closer touch with municipal than Public Works Department works.

3,044. He had at one time controlled the affairs of a small district cess fund, viz., that of Tavoy. Its annual revenue then amounted to Rs. 25,000 only and no special engineering staff was maintained for the construction and maintenance of its works. These latter were at that time entrusted to the Public Works Department. He had had some experience of the former system under which Deputy Commissioners constructed district fund works with the aid of an engineering staff but his recollections in the matter were not clear. In his opinion district fund works were not constructed and maintained at present as well as works of the Public Works Department proper, as the Department had not sufficient time to supervise the former properly. The construction by the Public Works Department of district fund works was for that reason sometimes delayed and inferior material utilized consequent on insufficient supervision. An improvement in this connection was possible in the larger districts, but he did not think any change could be effected in the smaller ones.

3,045. The Tavoy district was mountainous and rugged and possessed few village roads. Apart from the main roads which had been constructed by the Public Works Department, there were only jungle paths which were not maintained at all. Villages, however, were responsible by law for the maintenance of village communications, and responsibility in the matter was enforced in some districts. As a matter of fact, such responsibility was at present being increasingly enforced but he had not witnessed the working of the system on a large scale, nor had it been frequently enforced in the districts with which he had been connected.

3,046. Through communications were maintained by the Public Works Department, and roads which served two or more villages by district funds. Each district drew up its road programme periodically with the aid of the Deputy Commissioner and Executive Engineer, and he presumed the Superintending Engineer and Commissioner also reviewed the programme. From his experience of the working of the system in Tavoy he considered it satisfactory. He was not aware whether the Superintending Engineer and Commissioner dealt with the divisional road programme in the same manner as the Executive Engineer and Deputy Commissioner, but thought that such was the case. There had, however, been some difficulty in the matter because of the recent creation of a provincial communications committee for the formulation of proposals for the improvement of the roads in the province as a whole. The functions of this committee were to draw up a comprehensive scheme for main lines of communication in the province, taking the ordinary district road programme as a guide.

3,047. He advocated the creation of a permanent Road Board for the inspection of roads and preparation of road projects, not because the supervision of Superintending Engineers was inadequate but because of the delay at present experienced in the examination of estimates. In his opinion, the scrutiny of such estimates and the supervision of district fund works by Superintending Engineers was wholly unnecessary, and he considered that the itinerant members of the proposed Road Board should not be Superintending Engineers, since the appointments of Superintending Engineers would under his scheme, be abolished. He had not given mature consideration to his proposal, but thought a saving might be effected by the abolition of their establishments, and that a portion of the savings could be utilized in improving the pay of Assistant Engineers attached to the Buildings and Roads Branch. What he really wished to effect was the establishment of a certain number of Inspectors of Works who would take the place of the present Superintending Engineers of circles. He could not suggest whether estimates should be disposed of by the Board he proposed or whether they should be sanctioned by the Executive Engineer or Chief Engineer.

3,048. He was of opinion that a better class of subordinates could be obtained by the Public Works Depart-

ment by the payment of higher rates of remuneration, and had gathered from conversations he had had with Executive Engineers and other officials that the work of the subordinate staff was capable of improvement. The present salaries of the subordinate staff in Burma were too low to ensure honesty, but he could not say whether corruption was more prevalent in the Public Works Department than in other departments of the administration though he believed that such was the popular impression. It was because of this that he had recommended an increase in the rates of pay of the subordinate staff. The Deputy Commissioner did not, as a rule, deal with files regarding defalcations by the Public Works Department subordinates.

3,049. He recommended that the relations between Deputy Commissioners and Executive Engineers should be made somewhat closer. The latter officers were at present wholly independent of the former, the two authorities were in a manner co-ordinate, but he was not prepared to advocate the entire subordination of Executive Engineers to Deputy Commissioners. The degree of control exercised by Deputy Commissioners in Burma over other departments varied. For instance, the head of the local police service was subordinate to the Deputy Commissioner or the District Magistrate, but in the case of Conservators of Forests the control exercised was not as close, though it was, perhaps, somewhat closer than that exercised over Executive Engineers. The Forest Department was more closely associated with people living in the immediate neighbourhood of the forests than with those living in other parts of the districts; the Public Works Department, on the other hand, were more closely connected with the general public.

3,050. In his opinion the Deputy Commissioner should be kept informed of the progress of public works in his district by means of periodical progress reports, and he considered that their submission would keep the two departments in touch with each other. He also thought that cases of dispute between the Executive Engineer and Deputy Commissioner should be referred to both the Commissioner and the Superintending Engineer instead of only to the Superintending Engineer, as at present.

3,051. He was not in favour of the maintenance of government buildings by the departments in occupation, and thought that such an arrangement would be unworkable inasmuch as the quality of the repairs could not be guaranteed. He was unable also to agree with the suggestion that a grant for the execution of petty repairs to all revenue buildings might be made over to the Deputy Commissioner, in the same way as his grant for office and incidental expenses was provided, as he believed that even petty repairs required a slight technical knowledge which the Deputy Commissioner ordinarily did not possess. In his opinion the scheme could not be worked unless skilled assistance was given to Deputy Commissioners. It was true that district contractors were generally capable of undertaking petty repair work, but he doubted whether any Deputy Commissioner could supervise them. He was further doubtful whether officers in occupation of scattered buildings, e.g., police stations, were in a position to execute their ordinary annual repairs, and added that the present procedure, in spite of its disadvantages, was the best.

3,052. He believed from his conversations with numerous officials that the class of English engineers as a whole was open to improvement. His own experience of the former class in Tavoy had been satisfactory, but he had no personal knowledge of the latter class of engineer, or of promoted subordinates. He believed that the Secretary of State experienced difficulty in obtaining suitable recruits and that their average quality had been falling off. He could not, however, suggest the lines on which an improvement could be effected in the matter other than by increase of pay.

3,053. (Sir Noel Kershaw.) The Public Works Department did not meet the needs of other departments in some respects. For instance, the preparation of schemes and execution of work was sometimes delayed unnecessarily, and he did not think that such delay was due to shortage

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[Continued.]

of staff. He had heard that the delay he complained of was often attributed to schemes not reaching fruition for years, but had not come across any such cases himself. He believed that the road programme was divided into parts according to the degrees of urgency of the several works contemplated, because of the delay involved in the execution of works.

3,054. Part of the duties of the Road Board he proposed would be the periodical inspection of work executed by Executive Engineers. Executive Engineers were sufficiently competent, but the inspection of their work was desirable in order that the Chief Engineer should not be the only authority to judge of an Executive Engineer's competency. His impression in the matter was that the present five Superintending Engineers should be replaced by a Board with a chairman and two or three senior officers already in the service, in order that the Inspectors would have actual experience in road construction. He was not in a position to work out the remuneration of the officers he proposed but suggested that their salaries might be much the same as those of the present Superintending Engineers.

3,055. (Mr. Mackenzie.) In cases where an Executive Engineer disagreed with the views of the Deputy Commissioner, the former officer could, under rule, refer the matter to the Superintending Engineer for orders. He did not think that the only interpretation of the rule in question was that an Executive Engineer should either obey the orders of the Deputy Commissioner, or refer the matter to the Superintending Engineer. As a matter of fact his own relations with Executive Engineers had always been harmonious and resort had never been had to the rule. He had, however, heard of cases of friction between Deputy Commissioners and Executive Engineers. He did not think that an Executive Engineer would carry out a work without prior reference to the Superintending Engineer, in a case in which he disagreed with the action

suggested by a Deputy Commissioner, and had been requested to proceed with the work in view of its urgency.

3,056. (Mr. Cobb.) He had been in touch with a portion of the works of the Rangoon Municipality as Collector of Rangoon and a member of the committee which administered the town land reclamation fund. Contractors were employed and had proved satisfactory for the works of which he had knowledge, and the annual expenditure during the past two or three years on the reclamation of land and the construction of roads was approximately Rs. 3,00,000 or Rs. 4,00,000. He was not sure but thought that the Chief Engineer of the municipality supervised such work and that the Public Works Department scrutinised the estimates. He was of opinion that the works of the Rangoon Municipality were satisfactory and that no delay occurred in their construction. (Mr. Samuelson here explained that the town land reclamation works were carried out by a division placed in charge of a Public Works Department Executive Engineer who was directly under the orders of the Chief Engineer and it was only owing to the war and the depletion of staff that a temporary engineer was at present in charge. The reclamation fund was an integral part of the general municipal funds, and it was controlled by the municipality.) The scheme was initiated fifteen years ago by government and subsequently transferred to the municipality.

3,057. (Mr. Samuelson.) He believed that the communications committee had been appointed to examine the means of communication throughout the province and their linking up with railways and irrigation works, owing to the several districts having constructed roads without due regard to the requirements of adjoining districts.

3,058. (President.) The communications committee was not a permanent body, but had merely been appointed for the linking up of the entire system of communications in Burma.

R. STANLEY BAKER, ESQ., A.M.I.C.E., Executive Engineer, Public Works Department.

Written Statement.

3,059. (L.) Economy and suitability of methods of execution of public works.—Economy may be roughly divided into three sections,

(a) economy in design and specification;

(b) economy in employing that agency to do the work which will carry it out according to specification and within time limits at the cheapest rate; and

(c) economy by the use of labour saving machinery.

Section (a) depends largely on the amount of time available for the preparation of designs and estimates. In the writer's experience it is seldom that sufficient time can be given to this as the engineering staff of the Department is too small to cope with its work under present conditions. The evil is aggravated in Burma where the needs of the province are vastly in excess of the funds available for works. The result is that for every estimate which is funded many others are prepared which cannot be carried out, and as the strength of the Department is based on the money spent there is very little time available for getting out all the designs that are called for.

Section (b) would appear to be attainable by the simple process of calling for tenders and accepting the lowest. Unfortunately the lowest tenderer is usually some man who is quite incapable of carrying out the work, or who puts in rates below what the work must cost if done to specification, in the hope that he will be able to scamp it and thus make a profit. If his tender is accepted and he is kept to specification he will simply throw up the job and a great deal of time will have been wasted. Usually there are several men who could do the work, and the lowest of these is accepted, but the writer has known it happen that a good contractor will make up his mind to lose so much money by tendering below cost for every work in the hope that he will crush out all competition and eventually secure a local monopoly.

It will thus be seen that much depends on the Executive Engineer as to whether work is given out to the best advantage and that he must know what work really costs and all the local conditions, and that if the Executive Engineer happens to be dishonest and wishes to extort money from contractors he can always find plausible reasons for having given the work to or recommended any particular man. For this reason the writer is not in favour under the present constitution of the executive of increasing the powers of Executive Engineers with regard to contracts, in connection with which control by Superintending Engineers is very necessary. Such control to be of any use must be given by men of long experience in the execution of work, as a clever but unscrupulous Executive Engineer would have no difficulty at all in hoodwinking a layman.

It should perhaps be added that under the existing system of recruitment dishonesty among a percentage of the Executive, Assistant and subordinate grades of the Department exists as it does among sections of all the other departments of the Indian government and that conditions in India in this respect are very different from those obtaining in England. This rottenness extends down through all the working classes, and it takes more supervision to get a job done properly in this country than it does at home. (Since writing the above I have received from the Institution of Civil Engineers Sir Maurice Fitz Maurice's presidential address which brings out clearly on pages 6 and 7 the difficulty of placing contracts to the best advantage.)

(c). Economy under the third section is not in the writer's opinion always obtained. There are not, for instance, enough power driven concrete mixers or portable motor pumps in the province, but some advance is being made in this direction as funds permit. (In England such plant would be brought on to works by the contractor, but in Burma it is doubtful if there is a single contractor outside Rangoon who owns a concrete mixer or even a pump. The writer has never known one who did.)

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MR. R. STANLEY BAKER.

[Continued.]

3,060. (II.) Encouragement of other agency.—It is difficult to see how private enterprise can be further encouraged than it is under the existing system of calling for tenders for works. Most Executive Engineers would be only too glad to employ firms of standing for the execution of works if they would tender for them, but the fact is that rates are too low to admit of firms possessing trained engineering staffs competing except where steel-work or machinery or sanitary fittings are concerned. The writer's first job in the division he now holds was to build a church at a cost of about Rs. 96,000 or £6,400. Tenders were called for and advertised in all the chief papers in the province, with the result that no proper tenders were received at all, only piece-work agreements, and the work was carried out on piece-work with the aid of government arrangements and machinery. A similar experience occurred in the construction of an earthenware pipe line, except that one tender was received from a European firm in Rangoon, but at a much higher rate than the writer was able to get the work done for by a local man on piece-work.

(2). The conditions in different districts vary so much that unless a large contracting firm were to keep in constant touch with each it would not possess the necessary knowledge to enable it to tender for works in different places as they arose, and with the exception of Rangoon there is not enough work going on steadily to keep a large firm going in one district. If there was a living to be made by a trained engineer in contracting work in Burma a member of the Public Works Department would occasionally try it, but no one ever does, because they know too much about it.

(3). It would, therefore, appear necessary, further to encourage private enterprise, to raise rates all round. But it would still be necessary to have the work supervised and measured by competent engineers, as in England, and it is not evident where the economy would come in. Inspections of completed work are almost useless, and though with qualified engineers working as contractors, some organizing and fitting-out, etc., would be shifted from the shoulders of the Public Works Department, the reduction in staff possible would be slight especially remembering that the Department is understaffed at present.

(4). As regards the maintenance of works, those such as roads and water-supplies must, in India as in England, be in charge of some engineer. If the engineer works under a layman as in the case of a municipality there is no check on him. An attempt was made in Burma some years ago to carry out local fund works with local fund overseers working under the Deputy Commissioners. The result was an utter failure and the works all had to be taken over by the Public Works Department. The Deputy Commissioners could not check their overseers and the money allotted either went into the overseers' pockets or was frittered away.

(5). It cannot be too strongly insisted upon that any reduction in the quality of the engineering staff responsible for the administration, design, supervision and measurement of public works will result in a loss due to graft out of all proportion to any saving effected in establishment. If the engineer is a Public Works Department man he is responsible to his departmental superiors who can exercise some check. In either case much of the actual work will be carried out on contract, i.e., by private agency under the engineer's supervision.

(6). In the case of buildings there is no reason why each department should not be held responsible for the maintenance of the buildings it occupies. It is true that some difficulty might arise at first, but the system could be worked and would be more satisfactory and economical in the long run than the present one. Under the Public Works Department Code the officer occupying a building should carry out petty repairs to doors, windows and fixtures and charge for the same in his contingent bill. In practice such officers never do so, and the Public Works Department is burdened and worried with thousands of requests for petty repairs. In the writer's division there is a system of quarterly

inspections by subordinates of all buildings in their charge. The repairs needed are noted down and the probable cost entered and the repairs are sanctioned if funds are available. Now these repair requisitions come in every quarter literally by the hundred, and it is obviously impossible for the Executive Engineer or his sub-divisional officers to check the execution of all of them and there is no doubt that a good deal of unsatisfactory work gets paid for. If on the other hand each officer occupying the building had to arrange for his own repairs they would get much more individual attention. The present system is needlessly centralized. Each building would have to be reported on annually by the government engineer, as there would always be some officers who would divert the money allotted to them for repairs to other objects, such as making tennis courts or other unauthorized original works.

(7). It should be borne in mind that Indians are conservative and prefer to carry on works in the way their ancestors did. Without a considerable infusion of fresh western blood into the profession the progress made in engineering in the Public Works Department would not be maintained. The Public Works Department sets a far higher standard of work than is usual in private works.

3,061. (III.) Changes in organization.—No remarks.

3,062. (IV.) Relations with other departments and sub-branches.—In this connection the writer would like to emphasize the fact that every mistake made by the Public Works Department is prominent and seen by everyone, whereas the mistakes of other departments are only seen by those who suffer from them, always a small minority of the community. In England the plumber or other local artisan has always been regarded by householders as an enemy of mankind, and in India the same obloquy falls on the Public Works Department and should be suitably discounted. No difficulty has been experienced by the writer in his relations with the Sanitary, Architectural, and Electrical Branches of the Department.

3,063. (V.) Decentralization and (VI.) Simplification of procedure.—The rules regarding the purchase of European stores need revision. At present such stores may only be purchased from agencies or firms in India when they are actually in the country at the time the order is placed. If they are not in the country an indent has to be sent to the India Office (about 17 copies of each indent are required), and one is lucky if one gets the stores in six months. Even when the stores are in India the sanction of the local Government to each purchase over Rs. 500 has to be obtained.

(2). On the other hand, if a large contractor is employed he may supply European stores up to any limit in the ordinary course of his contract. But if one wants a bottle of ink for venturi meter recorders one has to send indents through the Secretary of State. In many cases correspondence with the makers is essential and dealing through the India Office is impracticable. In such cases the only course is to get the makers to send out what is wanted to some agent in India and then place the order with the agent when the goods arrive. This is a round-about and unsatisfactory method of conducting business.

(3). Another objection to obtaining stores through the India Office is that no matter how damaged or deficient they may be when they arrive, the India Office always says they were in perfect order and perfectly packed when despatched and they have to be accepted and made the best of.

3,064. (VII.) Education.—As far as the writer's experience goes the training now given at Roorkee is good technically, but the graduates from that college do not always possess a good general education, and this hampers them in dealing with other departments.

3,065. (VIII.) Practical training.—The writer is a firm believer in the necessity for practical training on works in England. Engineering in England is so much ahead of engineering in India that it would be well worth while to send home all Assistant Engineers appointed from Roorkee to England for at least a year (two years would

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be better) of practical training and no Assistant Engineers should be appointed from England without at least

one, and preferably two years practical experience on works in England.

Mr. R. STANLEY BAKER called and examined.

-3,066. (*President.*) The witness stated that he had had 12½ years' service in the Public Works Department and that he at present held the post of Executive Engineer, Maymyo Division.

3,067. He complained that the Public Works Department was burdened a great deal with the preparation of plans and estimates for works that never materialised, and stated that a large number of pending schemes could at any time be found in almost every divisional office in Burma, and that these schemes related to projects which had been sanctioned but could not be undertaken for want of funds. Under the procedure in force in Burma the Executive Engineer was in the first instance requested by a departmental officer, e.g., a Deputy Commissioner, District Superintendent of Police or Civil Surgeon, to prepare an estimate for a work. The Executive Engineer was not bound at this stage to submit a detailed estimate, but he was obliged to furnish the administrative officer with an estimate of the approximate value of the proposed work—a preliminary or stage I estimate—in the case of works other than minor works. His complaint did not have reference to these approximate estimates, but to the detailed estimates the preparation of which was undertaken by the divisional staff when the approximate estimates had been administratively sanctioned. No first stage plan was prepared for minor works by the Executive Engineer and administrative sanction was accorded on a detailed estimate, but Executive Engineers were given unnecessary trouble both in regard to minor works and large projects. For instance, he had on record in his office a pile of estimates which had been submitted during the past decade and still remained unsanctioned. A number of pending estimates related to famine works but his remarks did not refer to the estimates for such works. The reason for this accumulation of estimates was that administrative sanction was accorded indiscriminately and without regard to the possibility of funds being available for the erection of the buildings, with the result that inspecting officers when on inspections often asked for the preparation of estimates for which there was no prospect of obtaining funds, and an Executive Engineer could not very well refuse to prepare an estimate called for by an inspecting officer. He agreed that the formulation by the local Government of a rule to the effect that no detailed estimate should be called for from a divisional office unless there was a substantial chance that funds would be available to meet the cost of the work within two or three years would remedy the present disabilities under which Executive Engineers laboured. Under the existing procedure an Executive Engineer was only bound to submit a preliminary estimate when requested by an administrative officer to draw up an estimate, and only a Superintending Engineer could order the preparation of a detailed estimate, even for the smallest minor work. Administrative officers had therefore to obtain the Superintending Engineer's approval to the preparation of detailed estimates. When an Executive Engineer knew, however, that a detailed estimate would be necessary, he could prepare one without waiting for the orders of the Superintending Engineer.

3,068. Tenders were invited for the construction of practically every work by notices posted up in the Executive Engineer's office, court houses, the municipal town office, and the subsidiary offices of the division concerned. In these notices tenders were invited for complete projects, but a note was usually added to the effect that contractors might tender for separate portions of each work, since divisional officers usually preferred to engage separate contractors for the masonry and wood-work in a building. The reason why works were thus split up was that masonry contractors were usually not competent to carry out wood-work satisfactorily, and that the Chinamen who did the wood-work were not capable of executing masonry work well. He expressed

himself as willing, if he received a satisfactory tender for an entire project, to accept it and stated that such a course would reduce an Executive Engineer's labour.

3,069. A register of contractors was maintained in each divisional office, and Executive Engineers recorded confidential notes regarding the work of each contractor in this register. Superintending Engineers were expected to examine the register during their inspections and to satisfy themselves that it was kept up-to-date. Contractors were not classified according to the class of work they were capable of undertaking, but remarks to this effect were generally made against their names in the register. With the exception of Chinamen who were, more or less, the only *pucca* contractors procurable, the contractors available in his division were merely agents for the supply of material and labour. All machinery that was required for masonry work was supplied to contractors by the Department as they possessed only small tools and had no plant whatever. Certain of the contractors in his division were capable of undertaking projects to the extent of Rs. 5 lakhs, but he had few large buildings to construct. The Mandalay Post Office was one of the largest he had been engaged on and this building had cost Rs. 1,30,000.

3,070. Tenders for road construction were usually invited for particular sections, each section representing the length of road a particular contractor was capable of undertaking, and separate contracts were usually given out for earth-work and road metalling except in the case of small works. Executive Engineers would be willing, if reliable contractors were available, to accept complete tenders for road construction. The case cited in his written evidence of a contractor deliberately tendering at rates that were below cost price in order to stifle competition and secure thereafter a monopoly in the division concerned, was the only one of its kind that had come to his knowledge, but he surmised that this motive actuated contractors in quoting low rates in other cases. He had always endeavoured to distribute his works among several contractors in order to ensure competition and to avoid the placing of the whole of his work in the hands of a single contractor.

3,071. With regard to the powers of Executive Engineers to accept contracts he stated that there was no limit in the case of works executed by piece-work as such work could be stopped at any moment. In other cases the limit fixed was Rs. 5,000, and he was opposed to an increase of the limit because he considered that, with the divisional staff as at present constituted, it was only right that the Superintending Engineer should have some control over contracts, and that all Executive Engineers could not be trusted with higher power. For this reason he was only in favour of an increase in the powers of technical sanction of Executive Engineers from Rs. 2,500 to Rs. 5,000, but added that the limit might be still further increased in selected cases. He agreed, however, that from the professional point of view Executive Engineers as a class might be given authority to accord technical sanction to projects worth very much more than they were competent to sanction at present.

3,072. The construction of the church he had referred to in his written evidence was commenced in October 1913 and completed about February 1915. It was supervised for six months of the above period by an Assistant Engineer who was undergoing training and throughout the whole period by an efficient mason-mistri, and a sub-divisional officer, who was also an Assistant Engineer, who visited the work three or four times a week, while he himself visited it on an average once a week. He had found the Assistant Engineer who was undergoing training useful but explained that if this officer had not been posted under him nobody else would have been placed in charge of the work. The cost of the church was Rs. 96,000, and he considered

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that for a work worth about a lakh of rupees it was only necessary to place either a good mason-mistri or a reliable subordinate in immediate charge. The mason-mistri he had employed on the church building received a salary of Rs. 80 a month and was generally able to earn Rs. 2-8-0 a day, and it had been necessary to employ a man of his standing as the church had been designed by an architect and contained a good deal of intricate brickwork which required careful supervision. The amount of supervision that had been found necessary for the church in question was not essential for buildings of the ordinary type in Burma and it was sufficient in the case of ordinary wooden buildings to make over the plans to a Chinese contractor and to visit the works once a month. The standard of wood-work in Burma was not particularly low, but brickwork was very often badly carried out in cases in which an architect had not prepared the designs. Chinese carpenters were not as good as European carpenters, but their standard of work was good. Though he had not been to India he had heard from an engineer who had been engaged from Burma in 1914 in connection with the erection of the New Capital at Delhi that the standard of wood-work there was not as good as that procurable at Maymyo, and he added that this engineer had requested his sub-divisional officer to send to Delhi a window or part of a window made by a Chinaman in order to show the Delhi carpenters what good wood-work was. He considered that for masonry and iron-work a special training might be of advantage to craftsmen; and remarked that a Chinaman in Burma was capable, if provided with a good plan, of turning out almost any class of wood-work that might be required.

3,073. He explained that the recommendation in his written evidence that the departments which occupied buildings should be held responsible for their petty annual repairs was made with the object of relieving the Public Works Department of a great deal of petty work which did not require technical supervision. In his opinion, anyone was capable of seeing that a room was properly distempered or a ceiling properly painted, etc., and only special repairs should be executed by the Public Works Department. Contractors who employed skilled labour and who could be entrusted to carry out petty repairs without expert supervision were available and the same men who were employed for the purpose by Executive Engineers would work as satisfactorily under civil officers. He added that he had not consulted any officers of the departments concerned as to whether they would welcome the transfer to them of petty repairs or not, but presumed that those officers would probably regard the work so transferred in the same light as the Public Works Department, viz., as a source of annoyance.

3,074. The preparation of ordinary lump sum repair estimates gave very little trouble to the divisional staff. The "works authority" was a detailed estimate which it was necessary to prepare because it was not advisable to give a subordinate contractor *carte blanche* discretion as to the manner in which a grant for repairs was to be spent, and it enabled the repairs alleged to have been executed by subordinates to be checked. In England if a plumber or builder was called in, he was always asked to give an estimate before he was ordered to start work. Many of the contractors employed could not speak or write English and they could not therefore prepare the required estimates themselves. All repairs required were recorded as it was not feasible merely to explain them in detail verbally to a contractor as he would naturally forget them. The "works authority" slip was prepared by a subordinate, but the sub-divisional officer usually passed the bills for payment, and it was possible in most cases for an officer to check whether particular items on the works authority slip had been attended to. It was not possible to abolish works authority slips or repair estimates since there would then be no record of what repairs had been ordered or liabilities incurred and it was possible that an allotment for repairs might be exceeded. The list of repairs actually carried out varied occasionally from the repairs estimate, but in the majority of cases, if the works authority

slip had been prepared carefully, the two lists were practically similar.

3,075. Detailed sub-heads of account were maintained for major works but not for minor works. They were necessary as they enabled an Executive Engineer to watch the progress of a work and the expenditure on each sub-head, and without them it was possible for a particular sub-head to be largely exceeded without the Executive Engineer's knowledge. Sub-heads were not maintained for estimates below Rs. 5,000 and the amount of labour involved in the maintenance of sub-heads of account of works was slight and made very little difference in the size of the accounts establishment employed. He added that it would not make much difference if sub-heads were abolished for items worth less than Rs. 20,000, and that the present limit might well be raised.

3,076. The compilation of the divisional monthly accounts did not burden the Executive Engineer very much. It necessitated the employment of a well trained accountant and two or three accounts clerks, a great deal of whose work was connected with the checking of bills which could not be regarded as purely accounts compilation work. It was not possible to abolish compilation altogether as it was necessary to allocate expenditure to the several estimates. The accounts work did not occupy more than about 2 or 3 hours of an Executive Engineer's time each month, as the accountant in the divisional office was chiefly responsible for it and not the Executive Engineer. He agreed, however, that a large portion of the accounts work, which was necessary from an administrative point of view, was of no value from the Executive Engineer's stand-point, since the latter only required information in regard to the distribution of allotments and expenditure against them. In his opinion, the register of works, the stock accounts and the contractors' ledger were all that it was really essential to maintain from the executive point of view. If the accounts were compiled in a central accounts office all the divisional accountants would be called into that office. This would be an immense loss to the executive staff as accountants were a superior body of men well up in the rules, and they helped Executive Engineers enormously in the conduct of their offices and relieved them of much responsibility in connection with their accounts. When an Executive Engineer was on tour his accountant kept his office going and at all times dealt with a large volume of routine. The removal of the divisional accountants or any reduction in the educational and personal standard required would, in the circumstances, increase an Executive Engineer's office work to a distressing extent. He added that it would be an improvement if the Executive Engineer were only held responsible for the submission of a statement of receipts and expenditure with schedules and vouchers in support of each item shown in the statement.

3,077. With the reservation that he was not aware of the actual conditions in England at the present time, he adhered to his suggestion that engineers trained in India ought to be sent to England for practical training. He considered the proposal practicable and that it would be beneficial if such engineers instead of being trained as premium pupils worked as workmen on about ten shillings a week. He was doubtful whether the scope for practical training of civil engineers was larger in India than in England.

3,078. (Mr. Cobb.) Repairs were of two classes, ordinary and special. The former were provided for in the annual estimates and though provision was made for the latter yearly they were carried out only when the need for special repairs arose. For instance, if a building required a new roof owing to leakage the work would be classed as a special repair, but if some shingles only needed replacement it would be treated as an ordinary repair. The Executive Engineer was responsible for maintaining all buildings in his division in repair and was usually the officer who made requests for special repairs in the first instance. All repairs that were asked for, whether by civil departments or by the Public Works Department, were generally executed. The list of repairs prepared by the divisional subordinate

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was checked by the Executive Engineer, and if that officer noticed any items that were not *bond fide* repairs he struck them off the list. There were special safeguards in Burma, as in other provinces, and special rules in regard to the repairs of residential buildings. All estimates for special repairs to residential buildings were submitted to the Superintending Engineer, and the repairs executed in residential buildings were invariably inspected either by the Executive Engineer or some other officer, in special cases by the Superintending Engineer. It did sometimes happen that repairs were asked for and executed which were unusual in their nature and it was unnecessary in some instances to carry them out. The Executive Engineer was at present practically the only individual who could put a stop to this practice, but he advocated that this officer should not be responsible for ordinary repairs at all and that such work should be handed over to the occupants of buildings, in order that the best use might be made of the money available for repairs.

3,079. The church he had referred to previously was designed by the Consulting Architect to the Government of India. He was in favour of Architects being vested with larger powers in connection with the designing of buildings than they possessed at present, but surmised that their grant might lead to a considerable increase in the supervising staff, since buildings designed by an Architect needed more careful supervision than ordinary buildings. He presumed that the Government Architect would not be prepared to design and plan all buildings, but he agreed that such a system would lead to a general improvement in the standard of building work and the creation of a class of workmen who would be capable of understanding architectural work.

3,080. With regard to the statement that he would not give a Chinaman the brickwork of a building as well as the wood-work, he explained that Chinamen did not as a rule desire to undertake a contract for brickwork as they usually incurred a loss thereby, and that when they accepted an entire project they always sub-let such work.

3,081. The existing Public Works Department rates were adequate for the class of contractors at present available, but if contractors with trained engineers on their staffs were engaged the rates would have to be raised. He expressed himself as doubtful whether such increase in the rates could be met by a compensating reduction in the staff of the Public Works Department, as it would still be necessary to supervise the work of the contractors.

3,082. (Mr. Mackenzie.) All government officials in Burma were not in receipt of a Burma allowance in addition to their Indian rate of pay. An Executive Engineer received Rs. 100 a month Burma allowance until his salary including the allowance, reached Rs. 1,100, after which the allowance automatically ceased. Junior engineers as well as subordinates in the Public Works Department received a Burma allowance, and this fact certainly made it appear that the cost of establishment was rather high in comparison with the expenditure on works. Works also were more costly as the cost of labour and material was undoubtedly very much higher in Burma than it was in India.

3,083. It was not possible to abolish Superintending Engineers by increasing the disciplinary powers and powers of technical sanction of Executive Engineers. The inspection of divisional offices by Superintending Engineers was very necessary and he himself had often advantageously consulted Superintending Engineers, and this advice was all the more valuable in cases where

a junior and inexperienced Executive Engineer held charge of a division. Superintending Engineers also relieved Executive Engineers by undertaking a certain amount of designing work in their own offices, and he did not think any Superintending Engineer employed more than two or three draughtsmen for the purpose. The number of districts under an Executive Engineer in Burma varied from one to three. Each circle comprised seven or eight divisions, and the abolition of Superintending Engineers would increase the work of the Chief Engineer a great deal.

3,084. (Sir Noel Kershaw.) If an Executive Engineer noticed in an account maintained by sub-heads that a certain sub-head was likely to be exceeded, he was required to report the probable excess immediately and to submit a revised estimate if necessary. When an excess occurred under a sub-head it was not possible, as a rule, to secure lower rates in order to reduce the excess, but it might be possible to substitute sums by altering the design and making it cheaper either on that particular sub-head or on some other. It was not possible when deciding how a building was to be constructed always to consider the cheapest method of carrying out the work, as conditions very often altered during the progress of a work. He had personally known the rate for cement to rise from Rs. 11 a barrel to Rs. 18 during construction of a work. The maintenance of sub-heads of account was of material advantage as it gave an Executive Engineer early warning of probable excesses.

3,085. It was not the case that the execution of ordinary repairs was not supervised; a certain amount of supervision was exercised, but it was impossible to check every item of repair thoroughly. As a rule supervision was in many instances unnecessary for ordinary repairs. Hence nothing material would be lost by the acceptance of his suggestion for the transfer of repairs to the departments in occupation of government buildings. An officer who was not a professional engineer could see that ordinary repairs were properly executed in the same manner as a house-owner exercised supervision over a petty contractor who carried out repairs to a private building. The contractors who undertook ordinary repairs for private persons in Maymyo prepared and submitted their own bills.

3,086. Promotion to the rank of Executive Engineer was held in theory to be made by selection, but this principle was very difficult to work in practice. Under the present rule provided a man was considered fit he was eligible for promotion and hence selection was not really practised. He was not aware how unfit men had secured their appointments, and did not think there were any who, though fit when first appointed, had subsequently grown unfit. Some of the inefficient he knew had held their appointments for long periods. He thought that the Executive Engineers to whom he had referred in his written evidence had been dishonest throughout their careers.

3,087. (Mr. Samuelson.) He was not able to furnish any information as to the value of the minor works estimates that were pending in his office at any particular time. (Mr. Samuelson here remarked that it had been discovered a few years ago that about Rs. 100 lakhs worth of estimates were once pending in divisional offices.) He had not received a minor works grant for the past three years and allotments were usually only sanctioned towards the end of the financial year for any minor work that was urgently needed.

3,088. It was necessary for a subordinate to inspect each building in order to ascertain what repairs were required and it was not possible to do without this preliminary examination.

A. P. MORRIS, ESQ., A.M.I.C.E., Headmaster, Government School of Engineering, Insein.

Written Statement.

3,089. (VII.) Education, and (VIII.) Practical training.—The questions under inquiry in which I am particularly interested are those concerned with engineering education. I gather that the Committee do not wish

to inquire into engineering and technical education generally but only into those parts which prepare students for civil engineering appointments in government and private services; which is only a part of the ground covered by an engineering college.

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(2). The only institution in Burma dealing with engineering training is the government engineering school at Insein. This institution was founded some 20 years ago to train lower subordinates for the Public Works Department and it later on extended its scope to include upper subordinates. In 1907 new buildings were opened at Insein but the school failed to attract the Burman and the material turned out was often stated to be inferior to that of similar institutions in India. On the strength of these results a conclusion was formed that the Burman was not willing to take up engineering and could not be trained to become a suitable Public Works Department subordinate. The failure of the school to attract the right type of Burman, or indeed to attract any type of Burman in sufficient numbers, was due to its faulty organization and limited scope. In 1911 the school was reorganized. It has taken some while to clear up the bad impression which the Burman community had of it, to make it popular, and to get a suitable recruitment, but this last June 120 candidates sat at the entrance examination and the number of entries was limited to 50, not because the rest were unsuitable, but because there was no room for them. And this has not been obtained by in any way making the course easier. The amount of work required of the students is greater than before, the discipline is stricter, and the standard of entry is higher. As regards the quality of material turned out, the students trained under the new system have not had time to prove themselves, while competition for entry and consequent further improvement of recruited material has only just begun. The training given inclines towards practical rather than theoretical work. During workshop hours the students do a considerable amount of work, and this is actually done by them and not done by an instructor while they look on. I should like to include bricklaying among the subjects of workshop practice as the present standard of such work in this country is very low, but I would not undertake such instruction unless a man can be engaged from England.

(3). As regards the training of the subordinates affecting the quality of work in the Public Works Department, I think there is a good deal of room for change. My own impression is that the Public Works Department subordinate would be of far greater value if he were more like a clerk of works at home, a man who is generally master of one of the trades which he has to superintend and has a practical acquaintance with the rest. My impression of the Indian subordinate is that he has no hands at all, and is above touching a tool for fear of exhibiting his ignorance. Were the men really craftsmen they would not only be more valuable to the Public Works Department but they would also have a greater chance of employment outside. I do not know anything about the Indian craftsman but the Burman is naturally skilled with his hands and, given the chance to learn, makes a capable craftsman.

(4). The Public Works Department could improve their material, or rather we could give them improved material, if they would break up their services a little more and allow specialization. They have already been forced into this in the electrical and plumbing sections, but they could go even further. It would need a little reorganization perhaps, and some trouble, but the trouble, if it gave them better results, would be worth while. For a roads or irrigation subordinate surveying for instance is of greater importance than for a building subordinate.

(5). The demand for trained men outside the Public Works Department, municipalities, and railways is rather in the mechanical side than the civil side. The demand is being met by the school but I understand that the Committee do not wish for information on this.

(6). With regard to the training of students in the higher branches of civil engineering to qualify them as civil engineers for employment in government and private services, if any civil engineering posts of importance are

available in private employ employers are inclined to get engineers out from home to fill them, and I myself, were I an employer, would do the same. For subordinate positions there is a big demand for local men because they are cheap, but for the senior posts a home man is felt to be better and cheaper. I will not go so far as to say that money spent on university education in engineering would be wasted, but I think it would be distinctly better to use all funds at present available or likely to be available in this province in the training of craftsmen and subordinates and reserving higher training until the lower posts have been fully taken up. The number of higher posts available is so few that to train each individual employed would cost an unduly large amount. A few students might be encouraged to go to India to the colleges there. The chief difficulty in this line is the length of time a youngster has to be away and the consequent cost and risk of his moral deterioration. I notice that all the Indian colleges require a rather high school certificate; Madras asks for a B.A. degree. It seems to me that while these high literary certificates ensure a type of student which will pass examinations in book-work, they in themselves bar just the type of student who would make an engineer. So far as Burmans are concerned it should be possible for them to pass a certain amount of time at Insein and a pass certificate from the school should, by arrangement with an Indian college, qualify them to enter classes which will only necessitate their doing about two years in India to take their degree. I can arrange this with the City and Guild's Institute at home and if the passed students of this school can get the City and Guild's certificate in two years they ought certainly to be able to get an Indian degree of engineering in the same time.

(7). For the present, rather than see engineering training in Burma carried to degree standard, I would prefer to carry it into wider fields in the lower grades, for which form of extension there is ample scope. Our chief present need is increased staff.

(8). As regards practical training, the students of this school enter Public Works Department offices near their homes during the period of their long vacation in the first two years of their training; two months each year. In the survey season—January to March—of the third year they take up a practical survey for the Public Works Department for which the Public Works Department pays.

(9). This, which is a step in the right direction, was agreed upon as an alternative to the year of training recommended by Messrs. Atkinson and Dawson in their report. I think a little might be done to induce contracting firms who take up work for government to give opportunities of training to students, but there are only one or two firms who could do so with any advantage to the students, the bulk of the contractors in Burma are merely glorified coolies and mistris.

(10). It would be an advantage to students if, for the first few years at least, the Public Works Department made a point of keeping its young subordinates on work of instructive value. So many of them are pushed into the first place available and this is as often as not a corner where there is nothing doing in engineering and where they rapidly forget the little they ever learned.

(11). A difficulty which the Public Works Department might meet at some inconvenience to themselves is the choice of appointments for young subordinates with reference to their nationality. Burma is a wide province containing several different race groups and for a young subordinate there is a distinct amount of discomfort in being shifted out of his own area, say for a Karen to be put in Kyaukse, or a Moulmein boy in Arakan. It would cause some inconvenience it is true to arrange this, but if there is any desire to encourage the Burman to enter the service it can be done. In the same way, as far as possible, the young subordinate should be placed under an English or Burman superior. Once he has found his feet it does not so much matter; at the start it makes all the difference.

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Mr. A. P. MORRIS.

[Continued.]

Mr. A. P. MORRIS called and examined.

3,090. (President.) The witness stated that he was the Headmaster of the Insein School of Engineering and that he had held that appointment for the last four and a half years. He was a member of the Public Works Department, and had been appointed as Headmaster in October 1912.

3,091. There were two civil engineering courses in the school, one for upper subordinates and the other for lower subordinates, both of them being of three years' duration, and in addition a lower subordinate, having passed the course as such, could by undertaking a fourth year's course qualify himself as an upper subordinate. Thus in general it took a student the same number of years to qualify as a lower subordinate as it took him to qualify as an upper subordinate, although there was a great difference in the educational standards required for the two classes. Owing to lack of staff the second year lower subordinates were educated together with the first year upper subordinates, although in principle he would have preferred that there should be separate classes throughout.

3,092. The educational standard required for the upper subordinate class was the school final or matriculation and for the lower subordinate the 7th standard, but for the latter the 8th standard students were preferred and a large number of them were admitted. The age-limit fixed by the rules was between 16 and 21 but he had never paid any attention to this regulation. The actual average age of admission to the two classes was from about 19 years. The reason for fixing the maximum age at 21 was that, if a student joined at a later age, he could not pass through the course in time to get employment under government, the maximum age for admission to which was 25 years. Personally, however, he was not in favour of fixing an age-limit at all. He agreed that it was desirable in the interests of the students themselves that, provided they possessed the requisite educational qualifications, they should start their engineering education at a comparatively youthful age, but he was not in favour of debarring older persons also from acquiring such education by the fixing of an age-limit. He did not consider that such a proceeding would entail the expenditure of government funds on the education of a number of men who were less suitable material than the younger students, but contended firstly that the number of such men would be very small, and secondly that a low age-limit might debar some of the most suitable material available from entering. He did not, therefore, agree to the reduction of the age-limit from 21 to 18 and thought that, if an age-limit were to be fixed at all, it should be somewhat higher than that proposed, as otherwise a good many of the students would be ineligible for admission.

3,093. He considered that the students who had passed the 10th standard examination had a sufficiently good knowledge of English to enable them to follow their lectures in the engineering college. With reference to the view expressed by the staffs of certain colleges in India that the intermediate arts examination was not a sufficient qualification even for the upper subordinate course, firstly because the general education of the students was not good enough to allow of specialization and secondly because their knowledge of English was insufficient, he explained that the standard of education in the different parts of India varied considerably and stated that in the case of certain students from the Punjab of whom he had had experience, he had found that the knowledge of English of those who had passed the 7th standard was very poor. He considered however that the general standard of education in English in Burma was sufficiently high, although in his opinion the 7th standard was not quite high enough for lower subordinates. Their knowledge of English was rather backward and he would prefer to substitute the 8th for the 7th standard. At present about a third of the students who were admitted to the lower subordinate

class had passed the 8th standard and this qualification he considered quite good enough for lower subordinates. He added that in his opinion, if it was really desired to raise the technical standard, it would probably be an advantage not to insist on English at all, but to insist on the instructors qualifying in the vernacular and giving them instruction in the vernacular. He realized however that this was a counsel of perfection as it would involve the production of text books in the vernaculars which could not be done at present.

3,094. During the last two years an arrangement had been made with the Public Works Department under which students, before they finished their theoretical course, received instruction in practical survey work. Students were also sent during their vacations for two months in the first year and two months in the second year for practical training under Public Works Department officers. As this was the only opportunity which the students had of going home they were generally posted to some division near their places of abode, irrespective of whether there was any construction work going on there or not. This four months, practical training was all that the students could obtain, but in the witness' opinion it was insufficient and he was in favour of the substitution of a longer period.

3,095. The reason for not laying down the condition that, as in certain engineering colleges in India, students must take a practical course for one or two years on works at the end of their theoretical training was that government was unwilling to pay a living wage to the students during the period of such a course. A large proportion of the students were too poor to be able to pay their own way and he considered that, if a course of one year's practical training on works in addition to the three years' theoretical course were insisted on, a living wage should be granted to the students. He was in favour of withholding the college diploma until the combined theoretical and practical course had been completed. At present a certificate was given in regard to the theoretical course and if a student was able to obtain practical training under the Public Works Department this certificate was countersigned by the Chief Engineer.

3,096. There was only one guaranteed appointment for upper subordinates. Last year twelve students passed the upper subordinate course but this was an exceptionally high figure. The year before last nine passed and the year before that only six. Out of the nine students who passed during the year before last two joined the Public Works Department, one of whom was made permanent while the other remained as a temporary hand, two had gone to the Shan States, one joined the plumbing department, one got into a private firm and one had been employed under the Rangoon Municipality for a time but was now under orders to go to Mesopotamia. Practically all the candidates had thus been provided with posts, the majority of them getting appointments under government and the rest under municipalities, etc. He recommended that the government appointments should not be filled until after the candidate had undergone his practical training, as he considered this practical training as an essential part of an engineer's education. He was of opinion that it would be advantageous to introduce the system followed in Bengal under which there was an examination at the end of the practical course, upon the result of which selection for government service was based. Under that system the college authorities took into consideration the reports of the officers under whom the students had been trained, and weight was given to the results of both the theoretical and the practical tests in considering the candidate's fitness for government service.

3,097. In the Insein School of Engineering there was also a separate class for the training of practical craftsmen. They were taught joiner's or fitter's or smith's work. As a matter of fact they learnt a little of each before they

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[Continued.]

finally settled to one particular trade. It was rather difficult to say from what class students for the craftsman class came, but it was a condition of entry, laid down when the class was started, that all students joining that class should be Burmans. Only two students were admitted each year, as the class was still only in an experimental stage. He considered it desirable that all civil engineering students should receive practical training in carpentry and smiths' work and also do some practical building work. He had tried the experiment in the case of building work for about two years but since the last year had found it very difficult to arrange, owing to the increasing size of the classes. All students got considerable practical experience in carpentry, smithy-work and fitting.

3,098. He agreed with the view that the standard of carpentry and bricklaying in Burma was low compared with that in England, but could not say how it compared with the standard in India, as he had no personal knowledge of Indian conditions. He thought, however, that it was low enough to necessitate special arrangements being made to improve it and suggested that, if an additional staff were to be recruited, an instructor in brickwork would be a useful addition. He supported the recommendation made to the Committee that certain master workmen, for instance master carpenters, master bricklayers, etc., should be brought from England to give the necessary instruction; and stated that he had already made a similar proposal to the educational authorities. Such a man if employed should be attached to the Insein School of Engineering for at least part of his time, as building work practically ceased in Burma during the rains. He would then put the craftsman class under this man, but to justify the expenditure it would have to be enlarged. He was rather doubtful as to the utility of night classes under this instructor, as he considered that they would entail a great strain on a man who had had to work the whole day. An attempt to start night classes in Rangoon had been made at the Young Men's Christian Association, which had introduced business classes; he was not sure whether there was any class for technical subjects as well.

3,099. He suggested that some opportunities should be given to the passed students of the Insein school to enter the engineering colleges in India. The chief stumbling block was that the Indian colleges laid down very high literary qualifications which wasted a good deal of a student's time and of which he did not see the utility. If a student had to spend four years on his education it would be better, he thought, for him to spend them in an engineering college rather than on a literary course. He suggested that the passed students of the Insein school should be admitted to the Indian engineering colleges with the same standing as if they had undergone a certain number of years' instruction in those institutions. The number of senior appointments in Burma was not large enough to justify the establishment of an engineering college in that province but a few of the selected students of the Insein school who desired to go in for higher education might well either be allowed to join the Indian colleges in order to qualify themselves as Assistant Engineers or be sent to England. The present arrangement with the Indian colleges involved so many years' residence in India that a Burman would not go there. Such an arrangement was in force in the Sibpur college, and though the principal was anxious to get students from Burma no one went there and none would go so long as the present system continued. He had had correspondence with the head of the City and Guilds Institution in London who had informed him that the students of the Insein school would be able to get their certificates there after only two years training and the same thing should, he thought, be possible in the Indian colleges. He admitted, however, that none of the students of the school had passed the City and Guilds Institution examination. One of the students had gone there but the witness did not know how he had fared.

3,100. When the witness took over the headmastership of the school in 1912 there were altogether 33 students

in the school of whom only 7 were Burmans, all the rest being Indians. One of the reasons why a Burman would not join the school was that there was a very strong idea that Burmans were not wanted. They felt that it was an Indian school and therefore were unwilling to go there. In reorganizing the school the first thing he had done was to lay down that all students must be domiciled Burmans, but even so it had taken him three years to encourage Burmans to enter. During that period the witness had spent a certain amount of time in touring in connection with the school work and he had been successful largely owing to the fact that he had a certain amount of influence among the Burmans. He did not think that the increase in the number of Burmese students was merely a temporary one, due to the special efforts which he had made, but considered that the increase would be permanent and that the Burmans would continue to come to the school in increasing numbers. He had advertised the courses a good deal and had sent a circular round to the schools from which his students were drawn, and had every intention of continuing to do so.

3,101. He did not agree with the suggestion that the Burman was practically non-existent in the Public Works Department, that he did not like the Public Works Department as a department, did not set up as contractor and had no taste for the building trade. The Public Works Department, distribution list showed it was true, that there were only a few Burmans in the upper and lower subordinate ranks, but this was due to the fact that the Burmans had had very uphill work in getting into the Public Works Department. When the Department was first organised in Burma, senior men from India had been imported who had preferred to employ Indians in the subordinate ranks, and these Indians had practically formed a ring to keep the Burman out. This phase had been common to all departments but the others had got ahead of the Public Works Department in this respect. He did not think that there was anything inherent in the Burman which made him unsuitable for building work. Neither was it quite true to say that there were no Burman contractors. About five years ago when he was in Kyaukse much of the petty masonry and earthwork had been taken on by Burman contractors. He had just come from Pakokku where he saw a Burman contractor engaged in building a private house with the aid of Burmese masons. Burman contractors were also employed on a new road that was being constructed. He admitted that there were not sufficient Burmese masons to cope with all the work, but they were not altogether non-existent. Practically all the pagodas had been built by the Burmans themselves and in his tour he had visited a village of stone-workers who had erected a stone pagoda. These men were skilled masons, the art being handed down from father to son and from master to pupil as well.

3,102. As regards the extension of the school buildings, he had placed certain proposals before the Education Department which had been more or less accepted, but the matter had been held over for want of funds. Neither the workshops nor their equipment was at present satisfactory and the workshop instruction could be improved if there were better accommodation. The school staff was inadequate and he had been pressing for an increase for a long time, as on account of the lack of staff he could not admit the number of students he desired.

3,103. (Mr. Cobb.) He did not think it was fair to prevent older students from joining the school. Men at the age of 22 or 23 who were in business or trade might join and acquire an engineering training without actually becoming upper or lower subordinates. He admitted, however, that by taking students at an advanced age a certain number of younger students whom it was desirable to admit were excluded, but pointed out that the number of these older students was very small and did not materially affect the situation.

3,104. (President.) He did not agree with the suggestion that the age-limit for admission should be fixed at

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[Continued.]

18 years, although, if considered necessary, either 18 or 19 years might be laid down, but he would prefer that no hard-and-fast rule should be made but that the matter should be left to the discretion of the headmaster. He did not think it would be unfair to take some candidates at the age of 16 and at the same time some at 20, both of them competing for government service. The school was not intended solely for government service, and hence the question was not one in which the educational authorities were concerned.

3,105. (Mr. Cobb.) He considered that the right type

of Burman was gaining admission to the school and stated that there had been no great trouble involved in getting the students. All that was required was to bring before the students and their parents the possibilities of employment offered as the result of a course of training in the school. The majority of the boys in Burma could not read and write English, but they could read and write Burmese. Great importance was attached to the physical tests which he conducted personally to see that they were properly carried out.

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[Continued.]

At Bankipore, Thursday, 22nd March 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member :—

W. S. BREMNER, Esq., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary).

The Hon'ble Mr. E. G. STANLEY, A.M.I.C.E., M.C.I., Chief Engineer and Secretary to the Government of Bihar and Orissa, Buildings and Roads Branch.

Written Statement.

3,106. (I.) Economy and suitability of methods of execution of public works.—(i.) *Are present methods economical?*—The establishment charges of the Public Works Department compare unfavourably with those of other parts of the world, as example, in India it is often 23 per cent. whereas in some Australian reports I have seen their figure was only 9 per cent. of the cost of works. Some reasons for these excessive figures are : (1), the superior establishment is mostly imported labour, (2) the officers of the Department are highly paid to keep them honest, (3) an unnecessarily elaborate system of audit designed to prevent dishonesty, (4) the numerical increase necessary in the number of supervising staff owing to inferior class of labour.

(2). As regards the first point, one reason why it is necessary to have English engineers is the reluctance of Indians to take up engineering as a profession. Most of them are extremely averse to manual labour and the strenuous life an engineer has to lead, and prefer more sedentary occupations which offer better prospects of emoluments. Also those students who go through a course of engineering at any of the colleges in the country find that their prospects of ultimate employment in government service are very limited; and at present there is but little scope for them outside government service, and it is no uncommon thing to find men with Assistant Engineers' qualifications who have failed to get one of the few guaranteed appointments of their year working as upper subordinates; and similarly, men who have qualified as upper subordinates being compelled to take the position of sub-overseers.

(3). An absurdity in the present system of accounts is the demand for sanctioned estimates before any expenditure is incurred. In the beginning of every official year expenditure is incurred in the payment of municipal taxes, staff looking after vacant buildings and such charges which go against the annual repair estimates of the buildings. These estimates are not prepared till after the issue of the final budget, and can best be done in the slack season during the rains. Any expenditure incurred before the estimates are sanctioned are treated by the Accounts Branch as "gross irregularities" although they disappear automatically during the year. Also when starting a bridge or building there are petty preliminary works as taking borings, digging trial pits, etc., required to be done before the estimate is prepared; such expenditure should not be classed as "objectionable" for want of estimate or funds.

(4). It is often said that the cost of work executed by the Department is excessive, this is due to the high standard of work executed. There is not the slightest question that cheaper work can be done by using second or third rate materials coupled with rougher finish than the present departmental standards permit of but such work is to be deprecated. In the long run any small initial gain is counterbalanced by increase of maintenance charges and discomfort to the occupants of the buildings.

(ii.) *Are present methods suitable?*—Yes, if materials and workmanship are to be of the best, but here the government is now on the horns of a dilemma. On the one hand, Architects are brought out to elaborate buildings at an increased cost; on the other hand, the cry is that work is too expensive even without them. Take the case of a residential house; 30 years ago people were content with mud walls, thatched roofs, ceiling cloths, lime-plastered floors covered with split bamboo matting, and provided chicks for themselves for doors and windows and verandahs. The mud wall harbours white ants and vermin and disintegrates with the slightest rain percolating the roof, hence first-class brick in lime walls, a cement damp-proof course and lime plastered walls are now the vogue. Thatched roofs entailed a heavy fire risk, sheltered snakes, often leaked and required frequent renewal, so now terrace and tiles are used requiring stronger walls. Ceiling cloths sagged, were generally blotchy in appearance and soon got dirty, hence the light terrace ceiling, planks, plaster on expanded metal or last of all stamped steel plates. The split bamboo matting collected dirt and was voted insanitary, the old lime plastered floor deprived of its mat protection broke up very quickly and now cement floors or Indian patent stone or tiles are demanded.

(2). Occupants of government quarters expect an abnormally high standard of comfort and maintenance which they would not dream of asking a private landlord to provide.

3,107. (II.) Encouragement of other agency.—Nearly all work is carried out by tenders which are publicly advertised. Most petty contractors are men with little or no capital. The reason is probably that men possessing capital find they can obtain better returns than investing it in the execution of public works.

(2). Where district boards maintain an engineering staff it would be quite feasible to entrust petty works and repairs to them. The only saving would be in not having two sets of men travelling over the same district. The district board could not work with less supervision than the Public Works employs, and its staff would have to be augmented, so there is really practically no gain.

3,108. (IV.) Relations with other departments and sub-branches.—As a general rule the Public Works Department does meet the requirements of other departments successfully. There are cases in which civil officers object to the restrictions in the Code, but these often save members of the Department from doing a great deal of unnecessary work. A newly appointed civil officer often asks the Executive Engineer for plans and estimates for works which are beyond his powers of sanction and is annoyed when asked to refer to his Commissioner, but it often happens that his Commissioner does not agree with him or that the works have been previously considered and rejected.

(2). In this province the Sanitary Engineer and his Assistants appear in the Public Works Department classified list, but neither he nor his Assistants have been

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[Continued.]

trained in the Department and they are not under the orders of the Chief Engineer, Roads and Buildings. The Chief Engineer, Irrigation, is a member of the Sanitary Board and as such sees all important projects.

(3). The Government Architect works practically under and in conjunction with the Chief Engineer.

(4). The Electric Inspector works practically under and in conjunction with the Chief Engineer. At present he is mainly an Inspector of Mines under the Electricity Act, an adviser to the local Government under the same Act, and the designer of new schemes. Lately the Inspector of Mines has taken over his duties as regards underground work and eventually an imperial inspector will relieve the Electric Inspector of the above-ground duties; when this happens the Electric Inspector will be free to carry out all electrical work in the province, but he must be provided with an accountant and his office staff strengthened.

3,109. (V.) Decentralization.—The Code is extremely

The HON'BLE MR. E. G. STANLEY called and examined.

3,110. (President.) The witness stated that he held the post of Chief Engineer, Buildings and Roads Branch, Bihar and Orissa, and that he had served for only two years in the province; one year as Superintending Engineer, and one year as Chief Engineer.

3,111. There were two buildings and roads and three irrigation circles in the province. These circles were not self-contained. The Western Buildings and Roads circle consisted of three divisions which were so situated that the entire charge of the Superintending Engineer overlapped with the charges of certain Commissioners; the bulk of the circle was within the jurisdiction of the Commissioner of the Chota Nagpur Division, but the Sambalpur Division comprised a portion of the Commissioner of Orissa's charge, and the result of this arrangement was that the Commissioner of Orissa had complained that he never saw the Superintending Engineer of the circle. The Eastern Buildings and Roads circle consisted of the Bhagalpur Division, the Patna Division and the Special Works Division. The Sone circle comprised three irrigation divisions and one revenue division. The Gandak circle had two divisions but one of these, the Gandak Division, was a buildings and roads and irrigation division. The staff in irrigation divisions executed both irrigation and buildings and roads work. All the roads in Bihar were maintained by district boards except the Grand Trunk Road which passed through the Sone and Western circles.

3,112. One list was maintained for officers belonging to both branches of the Public Works Department and transfers were made from one branch to the other as the object of the Department was to train men as far as possible, in their early days, in both classes of work, in order that when they were promoted to the rank of Superintending Engineer they might have had experience of the two branches. Hence no separate specialization in irrigation was encouraged.

3,113. The Sanitary Engineer in the province was not subordinate to the Chief Engineer, Buildings and Roads, but received instructions from and dealt directly with the Municipal Department of the local Government Secretariat. The Secretary to Government in the Irrigation Branch was, however, a member of the Sanitary Board, and in his capacity as such was brought into touch with the Sanitary Engineer's work. Schemes and designs prepared by the Sanitary Engineer were not subject to technical supervision, and were passed by the Sanitary Board on which the Chief Engineer for Irrigation was the only engineering member. The Sanitary Engineer was subordinate to the Chief Engineer, Buildings and Roads, in all the provinces except Bihar and Orissa and Bengal. The Sanitary Engineer in Burma was selected from the Superintending Engineers of the Department who had specialized in sanitary engineering, and if a trained specialist was obtained from England for this post it would be desirable to make the incumbent entirely independent of the Chief Engineer. But if, on the other hand, an officer who had been only a district engineer was

illogical as regards the construction of residential buildings. The rules require the capital cost of a house to be governed by the average pay of the occupant. No allowance is made for the varying cost of site or for variations in the price of labour and materials due to exceptional local circumstances, with the result that in one station a man may have a reasonably comfortable house and on his next transfer find himself in a much smaller and inconvenient building. The Military Department solved this question many years ago by giving standard accommodation to various ranks and disregarding what it costs to provide that accommodation. The rules for the supply of stores do not suit present conditions. It is quite unnecessary to indent on the Stores Department of the India Office for most of the materials used by the Department, seeing that large stocks of such materials are held by the numerous firms in the country amongst whom there is sufficient competition to guarantee goods being obtained at reasonable prices.

recruited, sanitary schemes should be criticised by the Chief Engineer to a greater extent than at present.

3,114. The Sanitary Engineer was in charge of a department which undertook both the preparation and actual construction of sanitary projects. He had two Assistants, who had been recruited on 5 year agreements, and one of these had a staff similar to that of a Public Works Department executive division. The present Sanitary Engineer and one of his Assistants had been recruited in India but his other Assistant had been obtained from England. The status of each of the sanitary Assistants was practically equivalent to that of an Executive Engineer of the Public Works Department. It was preferable, when sanitary works were situated sufficiently close together, for the Sanitary Engineer to possess a separate construction staff of his own. He did not think that the Sanitary Engineer's work was entirely separate from that undertaken by the Public Works Department staff, as that officer had to rely on the local executive in cases in which sanitary works were scattered over the districts. In view of the fact that several private firms were coming forward with schemes for water-supply and drainage, he thought there would in future be sufficient scope and continuity of large projects in the province to afford sufficient employment to a regular sanitary staff. The present staff was not on a permanent basis, but consisted of temporary men who had been recruited on agreements in order that their strength might be varied according to the requirements of work. The existing arrangement under which a separate sanitary staff was under the Sanitary Engineer was the best that could have been devised, but he was averse to the whole of this staff being retained on a temporary basis, as he considered it was preferable to recruit a small number of permanent men and to employ the remainder temporarily.

3,115. The Government Architect was subordinate to, and worked in conjunction with, the Chief Engineer who selected the designs to be prepared by the former officer, subject to the approval of the Member in charge of the Department, who was the final arbiter in the matter. In practice only important buildings were designed by the Government Architect such as large colleges like the Ravenshaw College to be constructed at Cuttack, the Greer College at Muzaffarpur and the new Patna University. The Government Architect had designed most of the buildings in the New Capital, but had had no connection with the construction of ordinary district buildings as it was not considered worth while troubling him with the designs for such buildings, for many of which there were type plans. In his opinion it was correct in principle to have type plans for buildings such as court houses, police buildings, etc., but not for residences, and he mentioned that almost all regimental buildings in India had been constructed on standard plans. He had not experienced difficulty with any type of standard plan owing to the variations of the sites on which buildings had been erected. The Government Architect did not

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[Continued.]

attend to the examination of designs prepared by officers of the Public Works Department in addition to the preparation of his own designs. He did not agree that the architect who designed a building was the proper person to construct it, provided such an arrangement was feasible without incurring extra expenditure, as the Architects employed by the Government of Bihar and Orissa were men recruited from England and consequently did not possess sufficient knowledge of Indian materials and labour. He added that as a matter of fact the services of the Government Architect were not required for ordinary work but only those of an architectural draughtsman. There would not be sufficient work in the province, after the construction of the Capital had been completed, to justify the employment of a Government Architect, and he was of opinion that a small body of Architects stationed at Simla would be sufficient for the designing of buildings for the whole of India. The Government Architect had been connected with the designing of the main buildings in the New Capital, where he had been resident for some time, and that officer had been in the habit of occasionally visiting the buildings and sketching alterations on the walls. The Executive Engineer in charge of the buildings division of the New Capital was not subordinate to the Government Architect, and the latter carried out such alterations as he thought necessary in collaboration with the former officer, with the exception of important changes which were referred to the Superintending Engineer for orders.

3,116. The main duties of the Electric Inspector to the Government of Bihar and Orissa were connected with coal and copper mines of which there were a large number. That officer had originally held charge of both underground and over-ground work but the Government of India had recently made the Chief Inspector of Mines the electrical authority for the underground work, thus leaving the Electric Inspector in charge of the over-ground work only. He thought that on the termination of the war the Government of India would probably depute their own Inspector to take charge of the over-ground work, in which event the Electric Inspector to the local Government would only be responsible for the general schemes of the province, in connection with which he had certain statutory duties under the Indian Electricity Act, and the supervision of the various equipments including the electrical supply of the Pusa College which was comparatively small. There would in time be a very large electrical installation in Patna city. A license had actually been granted to a firm which had been unable to raise sufficient capital and the schemes had consequently fallen through. Hence he surmised that government would have to start the installation and make it over to a company after running it for a few years. There were a number of electrical power installations in the province including a small one at Pusa, one at Ranchi in connection with Government House and the staff quarters, one at Puri House where His Honour stayed only for about 6 or 7 weeks, one large installation in the Gulzarbagh Press where all the printing machinery was run by electricity and another in the Gaya Jail Press, and an application had recently been received from a firm in connection with the erection of a central station for the supply of electricity to five or six collieries and the railway stations in their vicinity, and to anyone else who desired to be included in the scheme. The present Electric Inspector was one of the most junior men in India being on a salary of Rs. 600 to Rs. 800 a month, but if the work in connection with mines were taken away and there was not then sufficient work to justify the employment of that officer, he was of opinion that it would be advisable to revert to the former system, namely, the employment of an Electric Inspector for the joint work of the provinces of Bengal and Bihar and Orissa, and to retain only an electrician to supervise the government installations.

3,117. The Patna Municipality was the most important municipality in the province and employed an Assistant Engineer on a salary of about Rs. 400 a month, whose duties consisted in maintaining roads and of satisfying himself that the building rules had not been contravened.

The Public Works Department were, however, at present carrying out some road diversions and alterations in the town on behalf of the municipality. The large municipal sanitary schemes would be constructed by the Sanitary Engineer, but the construction of municipal buildings, both important and unimportant, would be carried out through the agency of ordinary contractors without resort to the Public Works Department.

3,118. District boards employed engineers on a salary the maximum of which was Rs. 1,000 a month, but the salary of such men depended very much on the funds at the disposal of the boards. If the income of a particular district board was Rs. 4 or 5 lakhs, an engineer on the maximum pay would be employed, but in the case of a district board the income of which was only Rs. 1 lakh an engineer on a much lower pay would be employed. In addition to its engineer, a district board employed its own clerical and works staff, and was entirely self-contained in connection with the construction of its own buildings, bridges, etc., but he was uncertain as to the system under which large buildings of district boards were constructed. The only officer of the Public Works Department concerned with the district board staff was the Superintending Engineer. He was termed the "Inspector of Works" and as such was required to supervise the principal district board buildings and roads in process of construction. His official powers consisted only in the forwarding of inspection notes to the chairman of the district board and in making suggestions in connection with the construction of work, but in actual practice he issued instructions on the spot. District board estimates above a certain amount, which varied with the class of district, had to be approved by the Superintending Engineer.

3,119. He explained in connection with the appointment of district engineers that a list of applicants was usually sent unofficially to the Inspector of Works, who selected three or four names therefrom and advised on the qualifications of such candidates. The district board then made their selection subject to the approval of the Commissioner. Certain rules had been laid down with respect to the minimum qualifications necessary for the appointment of district engineer, but the local Government had power in exceptional cases to appoint a man who was not in possession of such qualifications.

3,120. All the roads in Bihar, with the exception of the Grand Trunk Road, were maintained by district boards. But he stated that there were a larger number of government roads in Orissa and Chota Nagpur as there were large *khass mahals* tracts in Orissa in which there were no district boards. Government made grants to district boards in connection with the maintenance of roads and special grants for the construction of their bridges, provided such boards were not in possession of the necessary funds and each case was considered on its merits. If district boards took over the maintenance of the remaining roads in the province they would not be kept in such efficient repair as was the case at present. As a matter of fact, district board roads were not maintained in such an efficient manner as those maintained by the Public Works Department, and this was largely due to the lack of funds. No advantage would, however, be gained if government made a grant to district boards for the maintenance of the Grand Trunk Road. (Mr. Bremner here quoted an instance in which a portion of the road in question in Orissa had been offered to a district board for maintenance, with the necessary grant, but in which the board had refused to take it over on the ground that government should maintain it as it was a government road.)

3,121. District boards constructed and maintained no government buildings with the exception of those in out-of-the-way places like the Palamau district in which it was not worth while starting a sub-division. For such works the boards were paid 15 per cent. in addition to the cost of the building, the district engineer being granted 5 per cent. as a personal allowance. This arrangement proved quite satisfactory as the buildings in such cases, though not of the same class as those constructed at headquarters, were quite good enough. He believed that district boards did not favour the arrangement by which

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their engineers were granted 5 per cent. as a personal allowance because it resulted in those officers paying an undue amount of attention to the construction of buildings for the Public Works Department in preference to the ordinary district board work.

3,122. He recommended that district boards should take over all buildings within their jurisdiction, with the exception of large important buildings, which would continue to be constructed and maintained by the Public Works Department, grants for the purpose being made by government. District boards would, if his recommendation were given effect to, require additional staff in ratio to the reduction effected by the Public Works Department, but a substantial amount of duplication would be avoided, thereby reducing the combined travelling allowances of the Executive and district engineers by practically half.

3,123. The statement furnished to the Committee showed the expenditure in the Buildings and Roads Branch for the years 1912-13 and 1913-14, figures for those years only being available. The average spent on works in the New Capital had been Rs. 18½ lakhs a year. The reason why the establishment was larger in Bihar and Orissa than in other provinces was because there was a larger number of irrigation divisions. The expenditure in such divisions was small in comparison with the total expenditure, but this was not because the standard of expenditure in the Buildings and Roads Branch was unduly high. The expenditure of a Superintending Engineer in Bihar was small when compared with that of a Superintending Engineer in Burma, whose average expenditure amounted to Rs. 26 lakhs a year while the average of the former amounted to Rs. 15 lakhs only. A Superintending Engineer in Bihar and Orissa held charge of three divisions but was already overworked, largely owing to the number of returns submitted to him. He therefore considered that a large number of such returns should be abolished as it had been his experience that an engineer in the province was much more burdened by office procedure and accounts than was the case in Burma. He did not think, however, that the existing establishment could be reduced if a modification of the excessive office procedure and accounts were introduced, as the irrigation divisions could not be altered because they fitted in with the canals and their areas while the other divisions were all large and could not be doubled up.

3,124. He did not agree with the proposal that the post of Superintending Engineer should be abolished, as he was of opinion that the functions performed by that officer were of a very useful character. It was true that there were several Superintending Engineers who were nothing more or less than post-offices, but if the right type of officer was obtained he saved government a considerable amount of money in economies and improvements effected in connection with the various schemes which passed through his hands.

3,125. He did not agree with the contention that, as an abnormal amount of supervision was at present exercised by Superintending and Chief Engineers over Executive Engineers, the powers of the latter should be largely increased and that they should be held responsible for practically all engineering work carried out in India subject to the general control of the Chief Engineer. The proposal was based on the assumption that there was a very high standard of efficiency amongst Executive Engineers, in fact that such officers were all first-class men, and it would not be workable because out of 100 Executive Engineers 30 or 40 actually needed a great deal of supervision, or looking after.

3,126. Sub-divisional officers in the province were not empowered to make payments amounting to more than Rs. 10. But two men in the Bhagalpur Division had drawing accounts of not more than Rs. 200, their final bills being sent to headquarters for check. He had had experience in this connection in both Burma and Bihar and Orissa and saw no reason why sub-divisional officers should not make payments, particularly as the concession would relieve Executive Engineers of a great deal of detailed work and save them a lot of trouble.

3,127. He was emphatically in favour of the system under which the Chief Engineer was also the Secretary for the Department, and advocated no change. The Chief Engineer was generally overworked on account of the mass of routine work with which he had to deal, and hence could not devote more time to professional schemes.

3,128. The Superintending Engineer and Commissioner discussed questions connected with the construction of work but they were independent of each other. Similarly, the Executive Engineer was independent of the Collector, and the arrangement was perfectly satisfactory from the Public Works Department point of view. The district heads of other departments were in much closer touch with the Commissioner and Collector, but the adoption by the Public Works Department of such a procedure would be distinctly bad judging from the conversations of officers of the other departments. As far as the Buildings Branch was concerned there was no reason why the different circles could not be arranged according to Commissionerships, but such a system could not be applied to the Irrigation Branch where the canals lay in certain areas.

3,129. Public works were carried out in the province by calling for tenders. The proportion of departmental work was extremely small and practically comprised only the repair of roads, for which class of work the adoption of any other system would not be satisfactory. Besides, contractors could not be induced to undertake this class of work in the manner required by the Department. The metal required for the roads was obtained after calling for tenders and the successful tenderer deposited it on the side of the road. The consolidation was then either carried out departmentally with a steam roller belonging to the Department, or a machine hired out to a contractor; the actual filling up of holes in the road and the repair of side drains, etc., being carried out departmentally by a gang of coolies similar to a permanent way gang. Special work, e.g., the construction of ceilings composed of reinforced brick, was also undertaken by departmental labour. Tenders for the construction of work were invited according to rates, as contractors were not willing to accept lump sum contracts except for very large works. There were no large firms in the province, with the exception of one which was unsatisfactory, but one of the Calcutta firms might accept lump sum contracts for the construction of bridges costing about Rs. 1½ lakhs provided they could secure a heavy margin for themselves. Reliable Calcutta firms would not accept contracts for the construction of work costing less than Rs. 1 lakh, in fact one of the firms which undertook the construction of four large buildings in the New Capital and 13 large houses would not accept contracts even for concentrated work costing less than Rs. 3 lakhs. Lump sum contracts were not given for the construction of the New Capital as the conditions were at present rather peculiar; everything had been rushed and the work had commenced practically without plans and estimates. The estimate for the secretariat building had been made out by the witness when he was placed on special duty about a year previously. The firm which had constructed the building had worked on a schedule of rates of the commonest and most used materials, and all other details were settled by the Executive Engineer with the approval of the Superintending Engineer who reported the rates arrived at to the Chief Engineer.

3,130. The supervision exercised over the construction of the New Capital was very much less than that exercised over buildings constructed by petty contractors. The buildings division of the New Capital spent Rs. 18½ lakhs a year, and the supervision staff consisted of one Executive Engineer, generally two Assistant Engineers and 5 or 6 upper subordinates in charge of a similar number of sub-divisions.

3,131. The firm which carried out the construction of the major portion of the New Capital were allowed 5 per cent. establishment charges, 2 per cent. for tools and plant, and 10 per cent. profit. He intended putting forward a proposal that, if the services of the firm in question were dispensed with, a new division might be formed.

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3,132. Cement, as a rule, was the only material supplied by government to petty contractors. Bricks were generally bought from a man who was not connected with the construction of buildings. They were manufactured between November and March and were generally not stocked in excess of requirements. If the necessary bricks were obtained from the contractor who had been entrusted with the construction of a particular work, his working season would be interfered with on account of the burning of such bricks, e.g., if a man had a sufficient stock of brick for the construction of a particular building, he would commence work in November, whereas, if he had to wait till February on account of the burning of his bricks, three months would be lost. Petty contractors in the province did not ordinarily manufacture bricks, and they were generally made by large firms who did not undertake the construction of buildings. Such firms did not usually stock bricks of any quantity for purchase by contractors, hence one had to wait till bricks for which an order had been given had been manufactured. There were no government brickfields in the province.

3,133. Lime was supplied by the contractor but government supplied cement in order to be sure of the quality. The necessity for the supply of cement by government might, however, be obviated if it was specified in the contract that only guaranteed cement could be used.

3,134. English cement was used in the construction of important buildings, and Indian cement in the less important works. The quality of the latter cement was very variable and subject to deterioration, and the supply of *Katni* cement had not been adequate in connection with the construction of the New Capital. This had probably been due to the war. Government had their own machines for the testing of cement.

3,135. The imported materials used in the construction of buildings by the Buildings and Roads Branch consisted chiefly of steel joists and he recommended that the Stores Department in England should be abolished, at any rate so far as indenting on that Department by the Buildings and Roads Branch was concerned, as there was a sufficiency of steel joists in the country to meet all requirements and the market quality of branded steel did not require further testing. Also because competition in this connection was sufficiently keen to secure fair rates. There was no government Stores Department in the province, and there were only two canal work-shops, one at Dehri-on-Sone, and the other at Jobra in Cuttack, which carried out repairs connected with irrigation work. The railway work-shops, as far as he was aware, carried out repairs to the tools and plant of the Public Works Department. The mathematical instruments belonging to the Department were repaired by the Mathematical Instrument Department, Calcutta, and the other requirements of the Department, e.g., steel or iron girders, were of stock pattern, and were bought from large firms in Calcutta.

3,136. The Police Department were empowered to construct buildings costing less than Rs. 2,500. Their scattered buildings involved a good deal of supervision and the sending out of men and materials for a great distance, hence they would cost a good deal more than was at present the case were they constructed by the Public Works Department. The Police Department were unable to construct a good building, and the class of work depended on the police officers themselves. In the construction of a roof, for instance, the Public Works Department would place the tiles close together and overlapping, whilst the Police Department would construct it with a much smaller number of tiles with the result that the roof would give trouble with the first shower of rain. If a cheap building were constructed by the Public Works Department the cost of its repairs would be a great deal more than that of those of a *pucca* building. The practice of erecting cheap structures was therefore not economical. He had not worked out statistics in connection with the actual cost of repairs to police buildings as compared with that for repairs to *pucca* buildings, but he had on several occasions rebuilt police

lines within three or four years of their construction by the Police Department.

3,137. He was at present endeavouring to induce the Jail Department to take over the repair of its buildings, but the difficulty in this connection was the insufficiency of skilled jail labour. A start had been made in this direction in Gaya, and the jail there had been given various buildings for maintenance, which latter was undertaken by prisoners and there was a large proportion of free labour. The system would not prove economical in the first year, but it would certainly do so after that period. It would be an advantage if the Public Works Department were relieved of all their petty repairs to buildings.

3,138. Repair estimates were most elaborate, every detail being included, e.g., the number of square feet of whitewashing, the number of panes of glass, etc. They were prepared six months ahead, and consequently one did not know whether the items included in the estimates would actually be required at the time of repairs or not. He therefore recommended that all repairs should be carried out on a lump sum contract based on the actual cost incurred on repairs during the past few years. It was true that one of the objections to such a system was that a contractor could not be trusted to carry out repairs unless an estimate had been prepared beforehand, but such a contingency depended on the Executive Engineer. He did not agree that no control could be exercised over expenditure and that one could not tell whether work had or had not been done under the system he advocated, and mentioned that a system had as a matter of fact been introduced in Burma under which the nature of repairs was entered in work-ships, and that if the Executive Engineer had the slightest doubt as to the repair which had been carried out, he had only to refer to the ship which afforded a check. The Burma system had not been tried in the Province of Bihar and Orissa, and he presumed the Accounts Department would immediately object if it were introduced. Municipal taxes were charged against repairs to offices, and public buildings were exempt from taxation. A ground rent was charged on residences and was paid in the first instance by the Executive Engineer to the Station Committee and recovered subsequently by inclusion in the rent of such residences.

3,139. He was not conversant with the rates for the construction of private buildings, but the rates for the construction of district board buildings were generally slightly lower than those of the Public Works Department. The brickwork of district boards was designated "first class," but would not be passed as such by the Public Works Department.

3,140. The limit for the construction of minor works was Rs. 5,000, that for major works being above that amount. Administrative sanction for the construction of minor works was accorded by the head of the department concerned to buildings other than residential buildings.

3,141. He complained that a large number of estimates were called for, for which no funds were available, and thereby threw an unnecessary burden on the Public Works Department in the preparation of plans and estimates for buildings which never materialized. This state of affairs was very often due to the revival of schemes which had been thumbed out a few years previously and abandoned, owing to a change of officers. He therefore considered that estimates should not be asked for unless there was a prospect of the money for them being available within a reasonable period. An unnecessary burden was also thrown on the Public Works Department by the frequent changes of ideas during the preparation of plans and estimates, particularly in the case of designs for the Education Department, e.g., no finality had been reached in connection with the design of certain colleges which had been under consideration for nearly two years. He did not know who was responsible for this, but in connection with the Greer College, a few days after the governing board had signed the site plan in consultation with the Government Architect, two members who had appended their signatures thereto sent in a separate design. These members had apparently disagreed when

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left to themselves and took exception to particular details but they eventually consented to the original design.

3,142. A Superintending Engineer had powers of technical sanction up to Rs. 50,000 and he was not in favour of an increase in these powers as the number of works which cost more than Rs. 50,000 was not so numerous as to place an undue burden on the Chief Engineer. Executive Engineers possessed powers of technical sanction up to Rs. 2,500 and he recommended that the limit should be increased to Rs. 5,000 in the case of the average engineer and to Rs. 10,000 in the case of selected officers. A good engineer was perfectly competent to pass designs for buildings which cost Rs. 10,000, and if he had 20 years' experience was as good as a Superintending Engineer. There was a great deal of selection for the post of Superintending Engineer.

3,143. He recommended that Executive Engineers should be granted the power to punish and dismiss lower subordinates provided the latter had a right of appeal to the Superintending Engineer. Similarly, that Superintending Engineers should be granted similar powers with respect to upper subordinates provided the latter had a right of appeal to the Chief Engineer. He had not had much experience of upper and lower subordinates recruited in the province, having seen only the local men engaged on the construction of the buildings in the New Capital.

3,144. (Sir Noel Kershaw.) Cheaper work could be executed by the use of second and third-class materials, but such materials were used only in the construction of servants' quarters and outhouses, etc., and not in the construction of any important building, as the initial gain would eventually be more or less counterbalanced by increased maintenance charges, and no saving would accordingly be effected. First-class materials were used in the construction of partition walls. These, however, were only five inches thick and thus led to a saving.

3,145. Questioned as to how the 30 or 40 per cent. of Executive Engineers whom he stated required a good deal of supervision had been promoted to executive rank, he remarked that government service was a mere machine, a man being promoted in due course. Selection for promotion would be preferable, but it was very difficult to exercise the principle in practice because seniority carried more weight; in fact a man had to be very inefficient to be passed over for promotion. The 30 or 40 per cent. of the engineers he had referred to were, as a matter of fact, qualified but lacked the necessary energy, and the Superintending Engineer was paid to keep them up to standard. Until recently the Department had no option in the matter of their promotion, but he agreed that such men should be eliminated from the service and thus greatly relieve the Superintending Engineer. The services of the Superintending Engineer could be dispensed with provided the qualifications of all Executive Engineers were ideal.

3,146. He valued the inspection of works by the Superintending Engineer because that officer could always point out to the Executive Engineer some improvement which could with advantage be made. The Superintending Engineer besides made valuable suggestions to the Chief Engineer which could not be improved upon by the latter officer, and gave valuable assistance in checking estimates and in the revision of designs. He favoured the employment of structural steel specialists for the construction of large bridges, failing which it might perhaps be possible to have, amongst Executive Engineers, a certain proportion of such specialists. The objections to the latter alternative, however, were that it would necessitate the Superintending Engineer seeking the advice of a junior officer and probably result in the frequent transfer of the specialist officers.

3,147. (Mr. Mackenzie.) For the construction of the new secretariat building, the contractors had been paid 17 per cent. above the actual cost of the work, 10 per cent. the allowance for profit and 7 per cent. for works establishment inclusive of tools and plant. The contractors had worked on their own schedule of rates, which was more than the ordinary schedule in some cases, and less in

others; but on the whole their schedule was lower than the ordinary schedule of rates. Nearly double the present establishment would be required for the construction of a similar building by the Executive Engineer and this would perhaps necessitate the formation of an additional division. The establishment charges of the Executive Engineer were about 16 per cent. so that the employment of a contractor for the construction of the building in question had resulted in a saving of about 6 per cent. 10 per cent. contractors' profits being roughly the difference over and above the schedule of rates.

3,148. He advocated that two upper and three lower subordinates of the staff of the Sanitary Engineer should be recruited on a permanent basis, on incremental pay. The Sanitary Engineer and his two Assistants had been recruited on 5 years' agreements, on the expiration of which the agreements would be renewed. He recommended that their pay should then be fixed very much on the lines of the executive branch, the Sanitary Engineer corresponding more or less to the Superintending Engineer. The pay of the former officer was Rs. 1,200—50—1,400 a month and that of one of his Assistants Rs. 800—50—1,000 a month.

3,149. The Chief Engineer, as Secretary to the Public Works Department, was certainly very much a servant of every other department and came into greater touch with other departments than any other Secretary to Government, as he received all their demands. A Secretary who was not an engineer would be deficient in the technical knowledge which was essential for the disposal of a large number of cases which passed through his hands. The Chief Engineer was generally chosen both for his Secretarial and technical knowledge, but many such officers had had no previous experience in the Secretariat before their appointment. For example, his predecessor had had no previous Secretariat experience, but it had been stated in his confidential report that he was a good administrative officer. Chief Engineers were chosen from Superintending Engineers by selection and it was essential for promotion to the post of Superintending Engineer that an officer was a good administrative officer.

3,150. (Rai Bahadur Ganga Ram.) The establishment charges of the Public Works Department were often as high as 23 per cent., but such charges were only about 15 per cent. in the Province of Bihar and Orissa, as compared with 15, 20 and 27 per cent. the charges in Bombay, Burma and Madras, respectively, and the reason for this low figure was that the bulk of the expenditure was at present purely local, the work being concentrated. One of the reasons for the excessive establishment charges in India was the fact that the superior establishment was mostly imported, as Indians were reluctant to take up engineering as a profession. This statement was based on conversations he had had with many men, one of whom, an Indian, had informed him that most Indians did not like to work with their hands.

3,151. Students who had undergone a course of engineering at any of the Indian colleges found that their prospects of ultimate employment in government service were very limited, and that the scope for them outside government service was also limited. Government could not of course find employment for every passed student, and to start them as contractors would require capital which government would possibly not be prepared to provide; he had no suggestions to make with regard to starting passed students as private contractors or engineers.

3,152. The statement in his written evidence to the effect that, in the case of residential houses, people were content 30 years ago with mud walls, thatched roofs, etc., referred only to private-owned houses and not to public buildings.

3,153. The Chief Engineer, Irrigation, was a member of the Sanitary Board and, as such, saw all important projects, but in practice the Sanitary Engineer discussed schemes with the Chief Engineer prior to placing them before the Board. There was no official rule under which the Chief Engineer was responsible for the schemes.

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3,154. The present method under which all executive work was done by the Sanitary Engineer and his staff was suitable, but if particular works were very much scattered, the Sanitary Engineer should only draw up the plans and leave the construction of the works to the Public Works Department, and act in such cases as Superintending Engineer.

3,155. There was a schedule of rates for the province and it had been revised since the formation of the province. The Public Works Department possessed a few typo plans, but those of Bengal were being used to some extent. He had recently prepared some new ones in connection with the jail and hospital buildings.

3,156. The Superintending Engineer as Inspector of Works inspected only works the estimates for which came to him for technical scrutiny; he did not inspect the smaller works. The Superintending Engineer had powers of technical sanction up to Rs. 50,000. These related to the construction of buildings which involved the preparation of new designs as well as to such buildings as were constructed according to standard plans, and he did not recommend any differentiation between standard and other designs in so far as the powers of Executive Engineers were concerned.

3,157. It was desirable in order to ensure general efficiency to have one cadre for all district engineers, and to promote and transfer such officers from one district to another irrespective of the considerations advanced by district boards; but he did not think the boards would tolerate such a procedure.

3,158. When irrigation divisions carried out repairs for the Buildings and Roads Branch they were allowed 20 per cent. on the cost of the work.

3,159. Designs for municipalities and district boards were executed free of charge, as local bodies did not generally possess the necessary funds to pay for them.

3,160. He did not know why upper subordinates were so distrusted, but was quite agreeable to the introduction of such improvements as could be effected in this respect.

3,161. The contractors were allowed 10 per cent. profit and 7 per cent. for works establishment, including tools and plant, for the construction of the secretariat building, and the cost of the Public Works Department staff of the Special Works Division averaged about 5 or 6 per cent. The contractors supplied the bricks used in the building at Rs. 2-8-0 per thousand less than the local contractors, that is, at Rs. 10 per thousand, and in addition laid 10 miles of tramway lines.

3,162. No indents for stores had passed through his hands whilst Chief Engineer, but he had, as Superintending Engineer, examined such indents very carefully to see that the conditions of the Code had been satisfied in respect to the materials required not having been available in India. He did not think there was any need for the existence of the Stores Department in England so far as the Buildings and Roads Branch was concerned, as the only imported implements required were steam rollers and electrical machines for which tenders were now invited from the different firms in India.

3,163. The percentage for repairs on the capital cost of buildings varied, it being about 1 per cent. for first-class *pucca* buildings and as much as 2 to 4 per cent. for other buildings, and there was no objection to the grant of a fixed sum to the Superintending Engineer for repairs to buildings.

3,164. (Mr. Cobb.) He did not desire to withdraw the statements in his written evidence that the officers of the Department were highly paid to keep them honest, and that an unnecessarily elaborate system of audit had been designed to prevent dishonesty. The two safeguards could be eliminated, but there would be no more dishonesty than there was at present if the elaborate system of accounts were abolished.

3,165. His professional work and that as Secretary to the Department were absolutely intermingled and could

not be separated. The letters received were addressed either to the Secretary, Public Works Department, or to the Chief Engineer, and the majority of the Superintending Engineers made no distinction in this connection. In the event of the Chief Engineer not being Secretary to the Department, but an Assistant to a non-professional Secretary, he would, in addition to his own work, have to undertake most of that of the Secretary who would perhaps be able to carry out his duties in a way but would not be able to understand or point out technical advantages and disadvantages. In his opinion, technical knowledge was essential for the major portion of the Secretary's work.

3,166. For the construction of the group of buildings in the New Capital which had been undertaken by a contractor, 10 per cent. profit was allowed and 7 per cent. for establishment, including tools and plant. In addition the Public Works Department establishment had cost about 5 per cent., so that the establishment charges had amounted to 22 per cent. in all. The construction of Under Secretaries' houses was now to be commenced and if this work was given to the contractor who had constructed the first group of buildings each residence would cost Rs. 25,000. The local contractor was willing to undertake the work for Rs. 1,500 less, but would take double the time, the quality of the work besides would not be so good. An additional division would have to be formed if the services of the large contractor were dispensed with.

3,167. The Public Works Department endeavoured to look ahead in regulating the supply of bricks, e.g., if the construction of a building was contemplated for the following season, the necessary number of bricks would be manufactured in the previous season and kept in stock until the time arrived for construction. The petty contractor was not able to adopt such a system as he was not in possession of the necessary capital.

3,168. The standards of work of district boards and municipalities were practically on a par, but not nearly so good as that of the Public Works Department. Comparatively speaking, the work of local bodies was second-class.

3,169. (Rai Bahadur Ganga Ram.) Bricks were obtained from the kilns and removed to the sites of work and there was no Stores Department in the province.

3,170. Under the recent orders of the Government of India a man could retire after 20 years' service if he so wished, and it would certainly be equitable, if government had the power to weed out men, to give such men the option to retire whenever they so desired with a suitable bonus.

3,171. (Mr. MacKenzie.) The contractors engaged for the construction of the secretariat building were paid the actual cost of the materials they supplied.

3,172. (President.) The contractors could quite easily lose money, e.g., on bricks and plaster, if their supervision was deficient. The actual schedule of rates for the construction of the buildings had been prepared by the contractors prior to the commencement of the work on the normal schedule of rates, and he did not think they made as much money out of the deal as they anticipated.

3,173. (Rai Bahadur Ganga Ram.) He believed that the contractors sublet a portion of their work.

3,174. (Mr. Bremner.) It was pointed out to the witness that his statement that sub-divisional officers did not make payments applied only to Buildings and Roads sub-divisions in Bihar, as sub-divisional officers in charge of Irrigation sub-divisions were also disbursers for the Buildings and Roads Branch, there being no distinction in such cases.

3,175. The district engineers he had met were all qualified men and he thought they could therefore be entrusted with petty work and repairs. He had had no experience of the second and third grade district engineers in Orissa whose salaries were about Rs. 500 and Rs. 300 a month.

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MR. BISHUN SWARUP.

[Continued.]

BISHUN SWARUP, Esq., Executive Engineer, Public Works Department.

Written Statement.

3,176. (I.) *Economy and suitability of methods of execution of public works.*—The methods adopted for the execution of civil works are, under the present state of things, suitable, but it is a question if they are quite economical, especially as regards repair works. For these a good deal of detail is gone into at present, taking much of the time and labour of the departmental staff, which could be utilized more usefully elsewhere. In the case of original works the details are necessary. The execution of these works is carried out through contractors selected according to the size of the work and is fairly satisfactory. Men with professional qualifications are not generally available for smaller works and the Department has to keep up a helping and supervising staff. This is necessary as contractors cannot otherwise be relied upon to do the work properly. It has been suggested that certain works, in order to reduce the cost of establishment, could be made over to the district boards for execution, but if good work has to be taken it must be well supervised, and supervision must be paid for, either to the district board, or to the staff kept up by the Department, or in the shape of higher rates to contractors keeping a costly supervising staff.

3,177. (II.) *Encouragement of other agency.*—Although there is no particular barrier against it, private enterprise (in which term I do not include individuals working as contractors) is not sufficiently coming forward under the existing system. The government having to keep up its own supervising staff, the rates for the execution of works provided in the estimates do not include the cost of supervision, so private building firms having in their employ any engineering staff worth the name cannot compete with individual contractors, owing to their costly staff; and if they take up any work it is given on sub-contract to petty contractors on lower rates than what the government pays its contractors, with the result that the quality of work suffers. Higher rates than those in the schedule are sometimes allowed to firms to meet the cost of their staff, but it is a matter of regret that this increase in rate does not always go to improve the quality of work, but is generally taken as an addition to profits.

(2). Among individual contractors there are many good and reliable men, with command of money and labour, who could be safely entrusted with large works, but not having any engineering training their work requires supervision all the same. Under the circumstances it is not desirable at present to entrust the construction of works of any importance to agencies other than departmental. The maintenance of buildings and roads, and construction of very small works and probably of roads can, however, be given out on lump sum contracts, on the contractors tendering their figures. This will cause a fairly good reduction in the cost of staff to government, will bring into being a number of contracting firms or individuals able to quote their figures, unlike the present men who accept blindly what is provided in the estimate and if they lose by their own carelessness come to bother the officers for increase of rates, and will gradually create a healthy competition and a general improvement of the profession. This attained, bigger works could also be given out on the same system gradually.

3,178. (III.) *Changes in organization.*—With the introduction of the system of the execution of repairs, etc.,

as mentioned in the last preceding paragraph, some slight reduction of the subordinate staff would be possible. This could, however, be done only gradually.

3,179. (IV.) *Relations with other departments and sub-branches.*—The Public Works Department meets in quite a satisfactory manner the needs of other departments of the government, which, with the work each has got and without the technical knowledge necessary, could hardly see to the construction and maintenance of their buildings themselves. Some of the departments, like Jail and Police, are allowed to carry out their own petty minor public works, but anything beyond minor works they cannot be entrusted with. The present relations, *inter se*, of the various sub-divisions of the Buildings and Roads Branch of the Public Works Department are satisfactory.

3,180. (V.) *Decentralization.*—The accord, in recent years, of increased powers to Superintending Engineers and Executive Engineers with regard to the sanctioning of estimates and disposal of funds has been a step in the right direction, and further progress on these lines is desirable.

3,181. (VI.) *Simplification of procedure.*—None of the provisions of the Public Works Department Code which regulate the execution and maintenance of works seems to be unduly restrictive.

3,182. (VII.) *Education.*—The government engineering colleges in India do not at present attract the best possible candidates, not because of any defect in the system of education, but because there is not much of a prospect for an engineer. The difficulty which private enterprise meets in government works has been explained above. As regards private works, construction for some of the firms are the only jobs available, the individuals having not yet learnt the advantage of employing professional men for their private works. The creation of the provincial service in the Department has made the government service less attractive. The development of industries, which chiefly require the services of engineers, is a desideratum still in its young stage in India.

(2). The colleges in India turn out engineers who with a year or two's apprenticeship can be fairly entrusted with works (of dimensions according to their experience) as regards safety of structure and proper execution. As regards economy, however, they have much to learn. To attain this object I would suggest that, while serving their apprenticeship, the engineers should be given definite charge of some small work or part of a big work which they should be made to arrange for themselves (of course under the general supervision of their superior) and carry out to completion; and the economy effected by them and the manner in which they carry it out, as also their dealings with all concerned, should form an important subject of their report after the apprenticeship. The engineers trained in this way will be better able to cope with the work required of them either in the employ of the government or of local bodies, or of private engineering and contracting firms.

3,183. (VIII.) *Practical training.*—The government gives practical training to nearly double the number of men it takes in its employ, but in order to facilitate the growth of private enterprise it would be better if such training is given to a few more men on application. If facilities are provided for, say, a dozen more candidates, it would, I think, meet the present requirements.

MR. BISHUN SWARUP called and examined.

3,184. (President.) The witness stated that he was an Executive Engineer of about 21 years' service, 9 years of which had been spent in the Buildings and Roads Branch and 12 in divisions which executed both buildings and roads and irrigation work. He held charge at present of the Eastern Sonos Division which was an irrigation division, but mentioned that a year previously, he was in charge of the Patna Division, a purely buildings and

roads division. He added that he had been recruited from the Roorkee Engineering College.

3,185. When he received sanction to a work he invited tenders according to rates, and accepted one of the tenders received. He did not invite the submission of lump sum tenders and had had experience of only one lump sum contract in the Doon area. The reason for not giving out lump sum contracts was that none of the

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contractors available could work on that system, and that most of them did not understand the system and preferred to work according to rates. Contractors in Bihar were generally deficient in professional knowledge except a few firms which employed an engineering staff of their own.

3,186. There were only three firms of qualified contractors in the province, two of which had their headquarters at Calcutta. The third had their headquarters in Muzaffarpur, and the other contractors were merely petty piece-workers.

3,187. For the encouragement of private enterprise he suggested that contractors might be encouraged first to undertake contracts for petty works and repairs, but not for large buildings on the lump sum system as there was not a sufficient number of large contractors at present, and he considered that if a start were made with petty works it would lead to the creation of big contractors and the establishment of engineering firms which in course of time might be given larger contracts. As there was no competition at present government would have to pay high rates if lump sum contracts were given out; it would therefore be best to start by giving out repairs on lump sum contracts. He did not anticipate any difficulty in the latter connection as the Executive Engineer would be aware of the normal cost of repairing a building, and would call for tenders for the maintenance of the building for a specified period, accepting only the lowest and most suitable tender. In calling for tenders the repairs, white-washing, colour-washing, etc., which would have to be carried out and which were at present detailed in the ordinary estimates would, however, have to be specified.

3,188. Detailed repair estimates were at present prepared by subordinates in the first instance. They were then checked by the Executive Engineer, and forwarded to the civil officer concerned for countersignature and sanctioned when received back. Tenders were next called for, and when the works were completed they were measured in detail and paid for after the completion certificates were signed by the civil officers. He did not think this method a satisfactory one for carrying out repairs to buildings as it involved too much elaboration, and the framing of detailed estimates did not serve any useful purpose. He was therefore in favour of an Executive Engineer, being given a specified sum annually for carrying out repairs, with full discretion as to the spending of the grant, and remarked that the introduction of such a system would result in a saving of establishment as the estimator's time at present taken to check estimates for these works would be saved and accounts would not have to be kept for each and every item. No checking of bills besides would be required, since if lump sum contracts were given a certain specified sum for a building would only have to be paid. He did not agree that unless an estimate was prepared in detail, the Executive Engineer would not be able to check whether the repairs had actually been carried out, as the items of repairs would have to be specified at the time of giving out a contract and the work would have to be inspected though not actually measured. He added that the system he advocated would result in a saving in the time of an Executive Engineer.

3,189. In his opinion the departments in occupation of buildings were not competent to keep them in a fit state of repairs. It was true that some departments, e.g., the Jail and Police Departments, were allowed to carry out their own minor works, but such departments could not be entrusted with anything beyond minor works as they had not the necessary technical staff for the purpose. The Jail and Police Departments were able to execute minor works, but other officers, e.g., the Collector, had no means of getting contractors or other men to do the work, or of effecting proper supervision.

3,190. He had had no actual experience of works executed by district boards, but had seen some of these works carried out. In some districts the Executive Engineer was a member of the district board and the witness himself while at Cuttack had been a district board member of the Puri District Board but as his experience had

been gained mostly in Orissa he did not know exactly what the practice was in this connection in Bihar where he had been for the last five years. The district board rates for work were a little lower than the Public Works Department rates, but their work was somewhat inferior. Their rates for the same quality of work would be the same as those of the Public Works Department. He had inspected district board works and was of opinion that their work was good enough for the *mofussil* stations. The Public Works Department buildings were situated only at headquarters of districts or sub-divisions and such government buildings as were scattered in the districts were not made of first-class materials. The police stations and quarters outside the towns were not built by the Public Works Department but by the Police Department itself and this applied also to buildings costing more than Rs. 2,500 which were constructed outside the towns. He had had no experience of police buildings built outside headquarters, but had had experience of other buildings and had found that the rates outside a town were generally lower than those in the district towns, e.g., the rates at Bankipore were higher than the rates in *mofussil* stations.

3,191. About half the days he was at headquarters were absorbed by accounts work. He was at headquarters on an average for about 12 to 15 days a month and had found that three hours of each day were taken up by the accounts work alone which consisted of the passing of bills and accounts and audit objections raised by the Accountant-General. The compilation of the monthly accounts occupied the first 12 days of each month, and usually commenced after the 25th of a month, when the cash books from the sub-divisions reached the Executive Engineer's office. The accounts were generally compiled by the accounts branch without assistance from the other branches, but assistance was sometimes rendered in the copying work. Six or seven schedules were submitted with the monthly accounts in addition to a number of schedule dockets, the number of which depended on the number of works in progress as the outlay on each work was supported by a schedule docket. He was required to sign about 20 documents connected with the monthly accounts, and each salary bill had to be signed three times.

3,192. He was empowered to sanction original works up to Rs. 2,500 only and repairs up to an unlimited amount. As a result of this the majority of the plans and estimates had to be submitted to the Superintending Engineer, and this indicated that the Executive Engineer should have larger powers of sanction. He therefore recommended that, as a Superintending Engineer's powers of sanction were limited to Rs. 50,000, an Executive Engineer might be given powers up to Rs. 10,000 or even more, thus obviating a great deal of correspondence which was at present carried on between Executive and Superintending Engineers. With reference to the remark in his written statement to the effect that the powers of Superintending and Executive Engineers with regard to the sanctioning of estimates and the disposal of funds had recently been increased, he explained that the Executive Engineer's powers with regard to the sanctioning of estimates were formerly only Rs. 200 but that they had now been increased to Rs. 2,500, and that the allusion to the disposal of funds referred to an Executive Engineer's powers to sanction estimates for repairs which were at present limited only by the budget allotment. A separate allotment was provided in the budget for each work whether it related to construction or repairs. No lump sum grant was provided for repairs in the Buildings and Roads Branch, but there was such a grant in the Irrigation Branch. Hence if an Executive Engineer's estimate exceeded the budget estimate he had to refer to the Superintending Engineer, who could sanction a reappropriation of budget grants within the sanctioned budget estimate. He therefore considered it was desirable that an Executive Engineer should be given a lump sum grant for repairs with full discretion as to its distribution. The fact that there was a particular allotment for each building under construction did not interfere much with the efficiency of work.

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If he had a number of original works in progress with separate allotments for each and found that he could spend more on one work than on another, he submitted a reappropriation statement to be sanctioned by the Secretary to Government, as the Superintending Engineer could not sanction it, and had never experienced any difficulty in having such reappropriations sanctioned as he invariably made a timely application and obtained sanction without delay. Hence the system of having separate allotments for each original work had been found suitable by him.

3,193. He had no objection to the transfer of the repair of government buildings to district boards, provided the boards could execute such repairs within the sums set apart for the purpose, and that they did not charge any percentage for such work. He was not, however, in favour of entrusting the construction of government buildings to the same agency as district engineers were generally drawn from the subordinate staff of the Public Works Department, but he added that he would have no objection to such a course if the district boards employed a better qualified engineering staff.

3,194. In confirmation of the statement that the Public Works Department and district board rates were practically the same he explained that he had worked out the figures in the Patna Division and found that the percentage of establishment came to 7.1 per cent, whereas it worked out as low as 3.0 per cent. in 1914-15 when the cost of original works was about Rs. 12 lakhs. He did not think the district boards could do work cheaper as according to the government orders 7 per cent. had to be paid to them—3½ per cent. for the preparation of preliminary estimates and 3½ per cent. for the detailed estimates and supervision of works, exclusive of the cost of tools and plant. But in cases in which the entire work was entrusted to the district board and the board utilised their own tools and plant they were given 15 per cent. But the additional 8 per cent. did not represent the cost of tools and plant only. The charge had, however, been fixed by government.

3,195. He had no official relations with the Collector except in regard to the submission of estimates and the execution of work.

3,196. With reference to the recommendation in his written statement that practical training should be provided for twelve more students he explained that the figure was an arbitrary one and that all he desired was that greater provision should be made for the practical training of students. It was preferable, if government could arrange it, that all students should undergo a period of practical training and it was possible to arrange for this if a number of works were in progress. He was not in favour of the payment of premia to Executive Engineers for the training of students as he considered that they should perform the work as part of their ordinary duties.

3,197. Upper subordinates in Bihar were generally recruited from the Sibpur College and most of them were engineers who had failed to secure guaranteed appointments, some also were passed students of the Bihar Engineering School. The Sibpur trained men possessed a better theoretical knowledge as they took up the engineering course whereas the latter went through the overseers' course only. The theoretical course of the students of the Bihar School of Engineering was sufficient for the duties which an upper subordinate attached to the Buildings and Roads Branch was called upon to perform, but a Sibpur College engineer student was better in the Irrigation Branch than a student from the Bihar School as there was a good deal of calculation work in that Branch. The theoretical training of the students of the Sibpur College was a little more than was necessary for the work they had to do, but there was not much to choose between them and the Bihar School students in practical work.

3,198. Lower subordinates were recruited from the Sibpur College as well as the Bihar School of Engineering. Their theoretical training was sufficient for the work they were expected to do and the standard was not too high.

3,199. There were no good *mistris* in Bihar, but he could not explain why this was so. As a resident of the United Provinces he was aware that good *mistris* could be had

there. A *mistri* was better than a lower subordinate for construction work, but was unsuitable for the preparation of bills, etc., for which purpose the latter were essentially necessary. Hence he advocated that there should be two classes of lower subordinates, one which had received a training in surveying and estimating and another which should be recruited from the *mistri* class for the supervision of work.

3,200. He had visited the Bihar School of Engineering, which had a class for artisans, but had had no experience of such students; he had observed that the students were not taught building work and that the artisan class was generally employed on mechanical work only. The school had a class for carpenters, but he had not seen their work and hence could not pronounce an opinion on the quality of their work.

3,201. (Mr. Cobb.) He had about ten lower subordinates under him and if he wanted an additional man he had to apply to the Superintending Engineer who decided whether he was necessary or not. If the Superintending Engineer decided to give him a man and had one to spare he could post him to his division, otherwise he had to apply to the Chief Engineer for sanction to his entertainment, on receipt of which he would be given a man. The selection of the individual to be appointed rested in this case also with the Superintending Engineer, who maintained a register of candidates, and the Executive Engineer had no voice in the matter.

3,202. He suggested that engineers should be placed in charge of small works or a portion of large works during their period of apprenticeship and mentioned that he himself, though not put in charge of a whole work, was made solely responsible for certain items of work on a water-works scheme by the Assistant Engineer under whom he had served his apprenticeship. This was, however, left to the discretion of the engineer in charge and was not done in every case, but he would like to see every student given similar opportunities during his period of apprenticeship.

3,203. He had been an Assistant Engineer for 7 years and acted as an Executive Engineer for 3 years prior to his being made a permanent Executive Engineer. He approved of the system of promotion by seniority and was of opinion that if a man did his work well and there was nothing against him he should be promoted to executive and administrative rank even if a better man with less service was available. He added that the principle of selection by seniority should only be set aside in the case of wholly inefficient men.

3,204. There was a schedule of rates for each district. This was not kept confidential but was known to all the contractors, and in submitting tenders contractors tendered at so much below the scheduled rates. He preferred to give lump sum contracts only for small works as the contractors available had no engineering knowledge to enable them to take up large works on the lump sum system.

3,205. He had been a member of a district board and found that the members as a rule did not take any interest in the works executed by the board; the district engineer did everything and the board simply passed all he did. The engineer consulted the chairman on certain points and the latter generally agreed with the former. Projects were discussed at meetings of the board, but the members did not evince much interest in the discussion. After they were agreed to, the engineer called for tenders and selected contractors. He then laid his recommendations before the board who had thus an opportunity of making their own selections but they invariably accepted the engineer's proposals as a matter of course.

3,206. Out of the percentage allowed to district boards for the execution of government works 5 per cent. was allowed to that officer over and above his pay, and it was only right that the district engineer should be given additional remuneration for the extra work thus imposed on him.

3,207. (Rai Bahadur Ganga Ram.) He had had experience of work executed by a large contracting firm which had taken up certain work on the same terms as other contractors. Tenders had been called for in this instance

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and the firm had asked for slightly higher rates only for masonry. They had employed a European Assistant Engineer for supervision, but the witness had not been able to reduce his supervision on that account but had rather to increase it as the firm sub-let the work and the sub-contractors turned out bad work which had to be rejected. The reason for this may have been that the 10 per cent. profit allowed to the firm had to be divided between the firm and the sub-contractors.

3,208. Payments under the system of giving out repairs on lump sum contracts would be made without measurements on the completion of the work. It had not been his experience that contractors were more keen on repair work than original work, and he had found contractors equally keen on both classes of work.

3,209. He had powers of sanction up to Rs. 2,500 in the case of original works, and could submit estimates up to that amount to the requisitioning department without a reference to the Superintending Engineer. For instance, if the Inspector-General of Police wanted some work to be done, he would prepare an estimate and if it were below Rs. 2,500 send it direct to the Inspector-General who would sanction it as head of the department. If, however, the building was a Public Works Department bungalow and cost the same amount, the approval of the Superintending Engineer as head of the department would have to be obtained. He intended that the increase of powers of Executive Engineers from Rs. 2,500 to Rs. 5,000 should have reference to all designs whether they were prepared by the Executive Engineer or whether they were standard plans.

3,210. By the remark in his written statement that the government colleges did not at present attract the best possible candidates he meant that the candidates were inferior both socially and intellectually, but chiefly intellectually, because of the poor prospects offered to engineers. The remedy was to give more practical training and thus enable students to become building

contractors and start firms of their own, which they could not do at present.

3,211. Minor calculations for discharges in the case of irrigation works and for joists, foundations, etc., in the case of buildings were occasionally entrusted to upper subordinates, but not to lower subordinates. He was very much in favour of the employment of *mistris* and considered that if sons of craftsmen were given the same training as lower subordinates they would make better lower subordinates.

3,212. (Sir Noel Kershaw.) The Executive or Assistant Engineer would check repair work carried out under the lump sum system and this would not add very much to the work of these officers as they had to do so already and the new system would only entail their going a little more into details. Such check might occasionally be entrusted to upper subordinates, but in no case should it be entrusted to lower subordinates.

3,213. With reference to the remark in his written statement that the system of giving minor works and repairs on lump sum contracts would bring into existence a number of contracting firms or individuals who would be able to quote their figures, unlike the present men who accepted blindly what was provided in the estimate and if they lost by their carelessness came to bother the officers for increase of rates, he explained that such requests were generally refused but that he had sometimes had to accede to them when he saw that the men had actually lost. In such cases one lesson was, however, quite enough and the contractor concerned was usually careful ever afterwards and did not repeat the mistake. Hence the number of contractors who accepted blindly what was provided in the estimate was gradually decreasing and there were now many contractors who knew their work well. The schedule of prices merely indicated what would be paid for each class of work. Contractors knew this and worked up to these rates; they were, however, not intelligent enough to add up the totals and offer to work on lump sum contracts.

F. C. TEMPLE, Esq., M.R.S.I., Sanitary Engineer to the Government of Bihar and Orissa.

Written Statement.

3,214. *Establishment.*—The Public Works Department has as a rule (with notable exceptions) seemed to me to discourage initiative and ingenuity in its younger engineers both Indian and European. In England for small works such as designing incidental culverts, or overcoming minor difficulties, the junior assistants are encouraged to put up their own proposals, which are criticised and modified by the seniors. In India, I believe it to be rare for anyone below an Executive Engineer to be encouraged to make out proposals.

(2). The present system of recruiting Indian subordinates is unsatisfactory. The upper and lower compartments into which the subordinate service is divided, are too rigidly separated. College training is on the whole good though there has been a tendency lately to reduce it unduly. Upper subordinates have to undergo a year's practical training which is good (there was recently a proposal to shorten the college course and extend the practical training by a year which would be bad). But very few are fit after one year's training as a student to take up the work of an overseer. I should recommend that all should start at one grade, i.e., the lowest sub-overseer. Promotion should then depend chiefly on ability and industry and that being equal the men with the upper subordinate certificate should be promoted the more rapidly. Lower subordinates should only be allowed to go up to a certain point. But a man in service should be allowed opportunities for qualifying for upper subordinate.

(3). The distinction between imperial and provincial should be abolished. This distinction bears particularly heavily on an engineer fully trained in England who is taken into government service after a period with some local authority. His Indian experience makes him a more immediately valuable servant than an equally well trained man straight from Europe and yet he has to

come in on a lower status. All men should be paid on the basis of the work they do; the leave rules should also be on an equal basis.

3,215. *Local authorities.*—In some cases, the work now done by the Public Works Department could be done by the district boards but in this province, under existing rules, only by the first grade districts. These alone have well enough qualified district engineers. In those cases it would be a sound improvement. The additional work would not be very much but it would be enough to emphasize the need of assistant district engineers. Most of the first grade district engineers are at present heavily overworked if they are to do their work properly. The tenure of office by district engineers is not altogether satisfactory now, being too much at the mercy of arbitrary and somewhat irresponsible boards. A great improvement would be to form the district and municipal engineers into a service, preferably for India, failing that for the provinces or failing that for the divisions. Inspectorships of Works should be opened to district and municipal engineers. At present in this province the Superintending Engineer is Inspector of Works and interests himself as a rule very little in local works. A whole time Inspector of Works would be a great help to an overworked district engineer. The qualifications for district engineer need to be raised at least to the same as those required for Assistant Engineer in the Public Works Department. If a general scheme is impossible it might be possible to arrange a divisional service of Inspector of Works, district engineers for each district and one or two Assistant Engineers for the division. The last would relieve district engineers going on leave and be deputed to districts in turn to assist with special works or heavy measurements.

(2). As far as my experience goes first grade district work is as good as Public Works Department work and appreciably cheaper.

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3,216. *Contracts by large firms.*—A possible method of carrying out works both small, original and repair, is to make a contract for a term of years with some large firm of good repute, binding the firm to keep all existing buildings in repair and to erect new ones up to some stated figure, on a schedule of rates for each district. This, if well supervised by competent engineers, might be very economical. But the contract would require to be strictly drawn, well supervised and rigidly enforced. First grade district engineers could very easily carry on headquarters work in this way.

3,217. *Specialized work.*—The ordinary Public Works Department officer is a very good general practitioner. But it is not in reason to expect him to keep up with the high degree of specialization that now obtains in the profession. It is in the very nature of his work and training during his Indian service, that electricity, modern water-supply and drainage and large house building should lie outside the range of his experience. That he should be asked to execute the highly intricate schemes prepared by the specialist is unfair to both. The specialist should be directly responsible for the execution of his own work. In this province a move has been made in this direction by the creation of a Sanitary Works Division under the executive charge of an Assistant Sanitary Engineer and under the superintendence of the Sanitary Engineer.

3,218. *General recommendations.*—The move towards decentralization and local self-government caused a

swing of the pendulum too far in that direction. The formation of the district boards in some cases resulted in each district treating the next as a foreign and frequently hostile country, which scarcely co-operated with one another in any way. The idea that each small and poor district board or municipality should only have such service as each could itself afford has resulted in an extraordinary patch-work. This has been partially concealed by the fact that government has directly carried on such works as it considered sufficiently important in backward places through the agency of the Public Works Department. In some cases there has been unnecessary overlapping of local authorities and Public Works Department officers.

(2). I should recommend an amplification of the whole organization, bringing all the Public Works Department, municipal and district engineers into one great service. Opportunities should be extended to outsiders of admission to service in any grade and at any age, simply depending on their qualifications and ability. Local authorities should subscribe according to their income to the general fund of this service and should have the right to appeal against the officer deputed to them. The delegation of officers should depend on the services required in each place. And where the local funds were insufficient to carry on works as well as government thought necessary, they should be augmented by grants from government, as is done at present.

Mr. F. C. TEMPLE called and examined.

3,219. (*President.*) The witness stated that he was Sanitary Engineer to the Government of Bihar and Orissa and that he had held the appointment for nearly two years. He had been recruited in India and received his training in sanitary engineering on various large water-works in England, but had undergone no special sanitary engineering course.

3,220. He had had about 11½ years' experience in India, having served in the Military Works Services as Garrison Engineer, Fort William, for about 18 months, for one year in the Punjab Public Works Department, Irrigation Branch, in charge of the Dera Ghazi Khan subdivision, and as District Engineer, Muzaffarpur, for about 7 years prior to his appointment as Sanitary Engineer.

3,221. His duties as Sanitary Engineer to Government included the preparation in his office of designs for the construction of water-works and drainage projects. Such designs were sometimes prepared at the request of local bodies and the remainder at the request of government.

3,222. He was uncertain as to what the annual expenditure on sanitary projects in the province had amounted to since his appointment as Sanitary Engineer, but he surmised that a sum of Rs. 1 lakh had been spent on such works during the year 1916. He could not say what the future annual expenditure on sanitary works would amount to, but mentioned that there were at present over 80 inquiries for water-works and drainage schemes pending in his office the estimates for which varied, some of them amounting to between Rs. 10 and 16 lakhs, while the cost of the remainder was small.

3,223. His staff consisted of two Assistant Sanitary Engineers, one of whom was an Englishman who had been recruited for the preparation of schemes, but the whole time of that officer was at present occupied on construction work. This officer who was in charge of the Sanitary Works Division of the Public Works Department which had been formed to carry out sanitary works under the superintendence of the Sanitary Engineer was assisted by a supervisor and three sub-overseers, but additional establishment had to be given to him for the supervision of municipal work. The other Assistant Sanitary Engineer was engaged in the preparation of schemes for government and various municipalities and made tours of inspection to outside works in progress. The remainder of the staff consisted of subordinates of different grades.

3,224. He was of opinion that the system of employing a separate sanitary staff for construction work was not only the best but the only possible way of carrying out work rapidly and to the English standard. He himself had had about 10 years' experience of sanitary work in India and had in addition witnessed the construction of such work elsewhere. He had also officiated for the Sanitary Engineer, Bengal.

3,225. Entire contracts had as far as possible been given out by him for the construction of sanitary work and this method was, in his opinion, quite the best for the execution of such work. Two portions of the contract for a large water-work at present in progress at Patna had, however, been given out piece-meal as these were so urgently required that they could not be designed and estimated in time for the whole to be taken up together. Another big scheme had recently been thrown open to tender but only two large firms had submitted complete tenders, the others having asked to be supplied with various materials.

3,226. All open schemes were worked at present by municipalities who made their own arrangements for maintenance and submitted their budget for the maintenance of sanitary works to the Sanitary Engineer for approval.

3,227. He employed a supervisor who had a fair knowledge of plumbing. As the Public Works Department attended to the sanitary arrangements in Government House, he was not aware how such work had been maintained. He himself attended only to the sewerage.

3,228. With regard to the recruitment of Sanitary Engineers he was of opinion that it was essential that such officers should have received a special training in the subject and possess special qualifications. Further, that they should, as in England, hold temporary agreements of 5 years' each, or other convenient period, which could be renewed if a man gave satisfaction or terminated if he proved inefficient, as a man who held a permanent appointment was liable to become stale and had not the same incentive to keep in touch with the latest improvements in his profession as a temporary one. As regards their rates of pay he stated that government should make up its mind as to what it wanted and be prepared to pay for it, the rate of pay in each individual case being decided by a system of bargaining.

3,229. His experience had been that the work of really capable district engineers was as good as that of the Public

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Works Department and sometimes better, but the question largely depended on the personality of the officer in charge at the time. He did not agree that buildings constructed by first-class districts were of a cheaper quality and not of the same standard of finish as those constructed by the Public Works Department because the bricks used were obtained from brick-making contractors and were of the same quality as those utilized by the Public Works Department. Besides, when he was a district engineer, the rates quoted by contractors for the construction of buildings were 4 or 5 per cent. below the Public Works Department schedule of rates. During the whole of his seven years' experience as district engineer he had employed only five contractors whose rates differed from the schedule of rates.

3,230. With regard to the selection of contractors for the construction of work, he explained that he usually selected a suitable man out of those who desired to undertake the work and recommended him to the chairman of the district board with whom the selection virtually rested. The selection, however, required the formal sanction of the district board and such sanction was usually accorded after the work had actually been commenced.

3,231. Under a system in vogue in the province the district board constructed certain work for government and charged the latter 15 per cent. on the capital cost. It was left to the option of the district board to allow the district engineer 5 per cent. of this percentage, that is, 2½ per cent. for the preparation of plans and 2½ per cent. for the construction of the work. As to whether the payment of such percentage was justifiable he was of opinion that if the district engineer were treated as a public servant to whom all the ordinary government rules applied he should not be paid a percentage on work constructed on behalf of government, but if that officer on the other hand were regarded as an outsider there was no objection to the grant of the percentage.

3,232. The budget was drawn up by the district engineer in consultation with the chairman of the board, who was as a rule very much interested in the matter. It was next placed before the finance committee, which was composed of certain members of the board, after which it was passed by the district board as a whole. The members of the district board under which he had served had evinced a considerable interest in the budget programme by participating in an intelligent discussion of its details, but he could not say whether this applied also to other district boards. After the construction programme was decided upon the district engineer prepared plans and estimates for the works. These were placed before the board for approval, but were not subjected to much discussion and were generally passed in their entirety. The works were then given out to contractors, and his experience had been that favouritism had not been shown in the giving out of such contracts.

3,233. First-class districts were capable of undertaking the construction and maintenance of all the roads and government buildings within their jurisdiction provided a grant-in-aid was made to them for such work, but their staffs would need augmentation. It was preferable to pay the district engineer proportionately to the magnitude of his work instead of a percentage on each work he constructed.

3,234. He was in favour of the proposal for the provincialization of district engineers and thought district boards would probably accept it.

3,235. It had been his experience that Superintending Engineers only inspected district board works when specially requested to do so and that such officers never conducted inspections voluntarily. On one occasion a Superintending Engineer, after making an inspection, returned to the office of the district engineer and asked that officer to write the necessary inspection note. The Superintending Engineer had power as Inspector of Works to stop a work, but he could not order the inauguration of any project.

3,236. It was possible to execute small original and repair works by making a contract for a term of years with a large firm of repute and to have them constructed

and maintained to a particular standard in accordance with a schedule of rates for each district. He could not say whether a certain firm would take up a contract of that nature, but was of opinion that other firms would. He added that if government made over its repairs to district boards, the repairs for the whole district, or in an area even greater than the ordinary district, could under suitable conditions be given to one contractor.

3,237. He was opposed to the shortening of the theoretical course in the Bihar School of Engineering in favour of a more extended practical course, as the present college course gave students only a theoretical training for general purposes, and any shortening of it would be dangerous. He had had experience of passed students of the school as he had given some of them a year's practical training during the past seven or eight years, and considered that their standard of theoretical training was not too high. He had also had experience of passed students of the Sibpur College, and was of opinion that the best men turned out from the Bihar School of Engineering were quite as good as any he had had, with the exception of Bachelors of Engineering, in other words that the best men of the upper subordinate class from the Bihar School of Engineering were as well trained as those from Sibpur.

3,238. He suggested that all subordinates should begin their service as sub-overseers and work their way up. His chief reason for this view was that an upper subordinate direct from college could not handle lower subordinates well unless he himself had worked as a lower subordinate. He was emphatically opposed to the separation of upper and lower subordinates in view of the fact among others that when two college chums started together, placed in the position of an officer and an inferior respectively, it tended to a breakdown in discipline and also to lower the standard of honesty in the Department. He considered that some of the best men he had employed had commenced as lower subordinates and worked their way up and, in fact, handled their lower subordinates much better than men recruited direct as upper subordinates. In his opinion there were more upper subordinates than there were appointments available, and he would abolish the distinction and start everyone on Rs. 50 a month. This really involved the disappearance altogether of the lower subordinate.

3,239. (Sir Noel Kerchaux.) District boards were anxious to obtain the best engineers they possibly could for the money which they could afford to pay, but he could remember only one instance in which a lower grade district engineer had, on account of his efficiency, been promoted to a first grade engineer. The fact that more men were not promoted to the first grade was due to the men not being worth more than the pay they were drawing.

3,240. The district board used two or three classes of the same materials for the construction of their buildings, but this did not account for the saving of 5 per cent. he had succeeded in effecting, as district engineer, as compared with the cost of construction of buildings by the Public Works Department; it was because the district board paid lower rates for the same class of work. His experience was not very extensive, but he had not found that the invariable result of using cheaper materials in the construction of buildings was that it so increased the cost of maintenance that the building ultimately became dearer than would have been the case had materials of better quality been used.

3,241. (Mr. Mackenzie.) In using second-class materials for the construction of buildings, there were other points to be taken into consideration, e.g., the cost of maintenance, the comfort of the occupant and the trouble to the officer deputed to carry out the repairs. The reason why the district board rates were cheaper than those of the Public Works Department, when he was district engineer, was that he worked on a lower schedule. His successor, he believed, still managed to keep his rates lower than those of the Public Works Department.

3,242. (Rai Bahadur Ganga Ram.) His salary according to the terms of his agreement was Rs. 1,200 rising to Rs. 1,400, and his agreement could be renewed after the

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expiry of five years. He did not contribute to the provident fund.

3,243. The Chief Engineer was consulted during the preparation of an important project and that officer first saw the completed project as a member of the Sanitary Board. The Chief Engineer occasionally checked calculations in the case of important projects.

3,244. The branches of sanitary engineering in which he had received a training in England were water-works and sewerage. He came out to India as a covenanted engineer in the Military Works Services, and had reconstructed the greater part of the Fort William water-supply when he was Garrison Engineer, and also worked out part of the underground sewerage scheme there which, however, had not been completed.

3,245. He was of opinion that the Sanitary Engineer's work should only be checked by a higher official provided that official possessed specialised knowledge.

3,246. He did not think it was desirable to start subordinates on a pay of less than Rs. 50 a month. It had been his experience that members of the district board rarely interfered with his selections of contractors.

3,247. (Mr. Cobb.) Members of the district board evinced an interest in the actual execution of district board works principally when such works were in the neighbourhood of their factories or *zemindaris*, and the suggestions made by them in connection with the construction of buildings, etc., were usually more useless than useful, e.g., if they desired a pontoon bridge instead of one of permanent construction they would be prepared to spend money on the former under the impression that it was the more lasting of the two.

3,248. When he was appointed district engineer there had been, he believed, about 40 applications for the post. He did a little canvassing for the appointment, but considered it was a fault in the right direction. He had not been interviewed with regard to the appointment, but had secured it by writing.

3,249. He was of opinion that the cadre system was the better system to adopt for the province, and in support of his contention cited the case of a district engineer of 25 years' service who had for the first 15 years been regarded as the best engineer in a particular locality but who had been condemned in the latter part of his service.

3,250. (Rai Bahadur Gangai Ram.) Another advantage of the cadre system was that a man's services could not easily be dispensed with, as was the case at present, e.g., if a district engineer fell out, for social reasons, with the chairman of the board.

3,251. (Mr. Bremner.) The witness explained that the remark in his written statement to the effect that it was rare for anyone below the rank of Executive Engineer to be encouraged to make proposals had reference to the Irrigation and not the Buildings and Roads Branch.*

* Mr. Temple afterwards wrote :—

I should like to be permitted to amplify certain points in the evidence which I gave before the Committee.

(1). The President pointed out that the expenditure in the Sanitary Works Division is so far very small. This is true but the division which was primarily created for the execution of works at headquarters has only been in existence for nine months and a great part of the works which it is to carry out are still in process of being prepared. In the near future it is hoped that this division will carry out in Patna-Bankipur the water-works scheme which may easily run to six lakhs; a sewerage scheme which will probably cost eight to ten lakhs and a revision of the surface drainage scheme which will cost three or four lakhs.

The whole method of supervision of sanitary works is undergoing modification. Most sanitary works are carried out by local authorities and it has been the practice in the past for a municipality to choose its own contractor subject to the approval of the Sanitary Board and appoint its own resident engineer or overseer subject to the approval of the Sanitary Engineer. This meant that as resident engineer or overseer a temporary man was engaged about whom very frequently very little was known and over whom there was no hold. Shortly after I joined this post I pointed out to government the great objection of this method of procedure

and I obtained sanction to appointing sanitary supervisors who should be servants of the Sanitary Board and could be sent out to take charge of works for local authorities. When they were not out supervising work they would be preparing schemes in office. Circumstances have been such that very little work has been going on outside headquarters and only two men have so been sent out to assist local authorities. I have already reported to the Sanitary Board that the method is working well and I have recently heard that the Sanitary Engineer of Bengal has adopted the same practice there.

In the case of really large schemes, such as the water-supply and sewerage of Puri will be, I have no doubt at all that the best method of carrying out the work will be through the agency of the Sanitary Works Division as is being done in Patna. For the smaller works in various other places the supervisor method will probably be sufficient.

(2). I was asked my opinion about the advantages of permanent and temporary appointments and I said that I thought that the temporary appointment method of obtaining men was to be preferred. That remark needs considerable qualification. At present the temporary man is very heavily penalised for being temporary; for instance, he cannot take leave unless his doing so involves no additional expenditure to government. If he is holding an important appointment which cannot be left vacant and in which therefore a substitute must officiate, it means that he has to pay his *locum tenens* his deputation allowance. Further, the leave that he earns is after long service very much less than that earned by the permanent man, because the temporary man cannot take furlough. I recommend the abolition of all the artificial distinctions between the permanent and the temporary men. Men should enter the service at a salary commensurate with their ability and the work that they are to do. They should all earn leave at the same rate and be entitled to it on equal terms. To a very large extent government could decide the number of officers that are required to do its work, and having done so, it could make their posts permanent but the incumbents of the posts need not be called temporary or permanent. They can be engaged as is usually the case in England on an agreement which states the condition of service and the procedure by which it may be terminated and may state a time limit which can be extended if it suits both parties to do so. I should recommend the substitution of the provident fund for the pension system. This has been done with success in the railways and district boards. The provident fund must be adequate and should give the same average returns to its recipients as is now enjoyed by pensioners. This may involve slightly raising the present salaries in order to make sufficiently large contribution by the individual possible.

(3). My remark in my memorandum that I believe it to be rare for anyone below an Executive Engineer to be encouraged to make out proposals has been challenged. And the challenger stated that one of the complaints against the present procedure of the Public Works Department is that many small schemes sent up are subordinates' plans and estimates merely countersigned by the superior officer. I would draw attention to the previous sentence in my memorandum and point out that the training of juniors will break down almost as much by the failure of the seniors to "criticise and modify" as by the failure to allow the juniors to send up proposals.

(4). With regard to the taking of outside works by district engineers I should most strongly recommend that government encourage the district boards to pay their district engineers better and then insist on their doing all public works in the district without any extra fees. Government would contribute the cost of provincial works to the district boards plus such percentage as is necessary to the district board for the additional establishment necessary for carrying out the work. With regard to any other outside work done by the district engineers the present rules are quite satisfactory. The district engineer is a whole-time servant of the district board but as is frequently the case with the whole-time servants in England, the board may permit the district engineer to give expert evidence, take up arbitration cases, or occasionally carry out a piece of private work and receive fees for doing the same.

(5). With regard to the method of recruiting Indian subordinates I consider it is essential that all guaranteed posts should be abolished. Presumably, they were necessary in the past in order to induce men to take up the engineering profession. There is no longer any need of such inducement. In fact, the profession is overstocked. It is doubtful if altogether the right type of man is being secured. The proper inducement for them is not a guaranteed post, which puts a premium on mediocrity, but a living wage in the starting grades and the prospect of a good salary for a good man.

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J. F. MUNNINGS, ESQ., A.R.I.B.A., M.C.I., Consulting Architect to the Government of Bihar and Orissa.

Written Statement.

3,252. A study of the Government of India, Public Works Department, Resolution No. 06-E.A., dated Delhi, November 24th 1910, leads one, so far as building is concerned, to the conclusion that the object of the present inquiry is to devise means whereby building practice in the Public Works Department may gradually be brought into line with that at home generally.

3,253. In no respect is the difference between home and Indian practice so marked as in the position of the Architect. In the latter his position is as in no other country in the world. In government service in India an Architect is considered a "specialist," and is not, as at home, the complete Architect responsible for the work, with control over all building and other operations connected therewith. He is not even responsible for his designs, for which responsibility rests with the Chief Engineer.

3,254. There have been modifications of the Public Works departmental system. One concerns the Consulting Architect to the Government of Bombay, which officer is in direct executive charge of buildings carried out from his designs by an Executive Engineer under his control. Another, for which there was no precedent made upon the introduction of Architects, concerns the way in which the past system of designers of buildings and other works having executive control of work carried out from their designs has been relinquished in the case of Architects.

3,255. Engineers, Sanitary Engineers and Electric Inspectors retain executive control over their own works. It cannot be contended that, of the officers under consideration, the Architect is incapable of practising his own profession in its entirety.

3,256. The present state of affairs is most unsatisfactory to government and not less so to the Architect, who, by being debarred from the complete practice of his profession, and being employed as a designer and draughtsman merely, loses touch with his profession as a whole and if an approximation to home conditions is to be made with the greatest advantage to government, this anomaly should be removed.

3,257. Any modifications of the present system of the Buildings Branch that would lead to the ultimate employment of Architects as Architects wholly, and not merely as "designers" or draughtsmen, would result in greater efficiency, economy, have a good effect on the building industries and trades, make for progress in architecture and have a beneficial effect on the profession.

3,258. The designer of a work is the one most interested therein, and, when in direct touch with it, is able to infuse those under him and the workmen with some of his own enthusiasm and interest, and draw out sympathy for the correct interpretation of his ideas. He is in a better position to direct the carrying out of his own designs than one who has little, if any, sympathy with or understanding of architecture, and who, as a rule, has had no training therein.

3,259. The Architect at present is in a position similar to that of a composer of a symphony who hands it over to a conductor with no musical training for execution by an orchestra reduced to the drums and cymbals.

3,260. It is extremely difficult for an Architect at present to awaken any sympathy in those responsible for the execution of his designs and he is sometimes obstructed in his endeavours to do the best for the work. The employment of the Architect in an executive capacity would lead to a greater understanding of his designs, to a sympathy with architecture, and a knowledge of the building trades with which he is conversant. This greater understanding would minimize the tendency, very marked at present, to over and under-estimate, as the case may be, work in cases

of doubt. The Architect, by being brought into touch with the workmen, materials and the markets, would be in a better position to design his work to suit local conditions with economical results. By arousing the latent interest of those on the works and by his powers to combine them in a common interest, "that of the finished work," smoothness in the running of the complicated building machine would be encouraged.

3,261. An Architect often finds that his designs have been altered in execution without his consent and expense incurred putting things right. It is surprising how few of an Architect's designs are carried out with any resemblance to the way in which they would have been had he been in executive control. The realizations of his design all fail in the handling and finish of materials. Materials with regard to their texture, colour, and position as part of an architectural composition are not understood, and are considered from the stand-point of their strength to carry weights merely.

3,262. In the New Capital at Bankipur a modification was made in the usual procedure and my office was located there, enabling me to exercise constant supervision over the carrying out of my designs with excellent results to the work. A consideration of the work in the New Capital, over which I had some influence, and works over which I had not, should convince any one of the advantage of an Architect's presence constantly on the works. I was fortunate in having the sympathy and co-operation of the engineers in executive charge of the works, and the contractors, and I am sure that they would be among the first to admit the advantage of having an Architect in touch with the actual work of carrying out his own designs.

3,263. In matters of construction, the employment of the Architect would, I am sure, lead to economy of material. It is not necessary to design ordinary buildings, particularly those of a domestic class, from a purely engineering stand-point; it should be quite sufficient if the needs of building construction as understood in other countries are observed: say, for example, the requirements of the London County Council Buildings' Acts.

3,264. The employment of an Architect in an executive capacity would not add to his present work, but tend to diminish it and lead to the standardization of details. The numbers of drawings and prints required would be reduced, and a saving in stationery made as being in direct touch with the work he could explain his designs and give instructions on the spot, which have now to be conveyed on paper. All preliminary designs and sketches would be made by the Architect, and not, as often done at present, by other officers, rendering their revision as a rule necessary when eventually put in the hands of the Architect for elaboration and detail.

3,265. So far as the intrustment of work to private agency is concerned, I am of the opinion that in provinces like Bihar and Orissa an extension of the system would be exceedingly difficult, and only possible in the case of really important works such as the New Capital at Patna where the work has been almost entirely carried out by a large contracting firm. The number of large building firms in existence at present is limited, and it would not pay them to take up small or even moderately sized works in outlying districts, and unfortunately, small builders capable of carrying out the work as a whole on a lump sum contract are practically non-existent. On important works again the substitution of private for departmental agency would not tend to economy unless a modification in the present methods of the Department was made, the Code revised, and the works carried out on a lump sum contract, and the specifications, the whole of the important drawings and details done beforehand for the contractors to estimate from; and would only be satisfactory if the conditions of employment were brought as nearly as possible into line with those under which private agency is operated at home.

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[Continued.]

3,266. The system of education in government engineering colleges with regard to building does not seem to me to be organized on a sufficiently broad basis to meet the needs of private agency or government. Courses on architecture in its entirety and in the building trades should be included in the curriculum. At present, graduates are not, in my opinion, qualified to undertake the designing or carrying out of buildings without further training, beyond that they at present receive on works after their college careers have closed.

3,267. In view of the above statements, I desire to make the following recommendations :—

(a). That in the place of the present Irrigation and Buildings and Roads Branches, two departments should be constituted. A general Engineering Branch to include irrigation, marine, bridges and roads, electrical work and sanitation, staffed and controlled by engineers : and a Buildings Branch to be eventually staffed by Architects and engineers and controlled by Architects. Under the term Architects, engineers who have qualified as Architects and have had the necessary training would be included. Use could be made by either department, as occasion may arise, of any officers of the other whose advice and help may be desired ; engineers assisting with special engineering features of buildings and Architects with the design of important bridges.

(b). The Consulting Architect to the Government of India might be considered the head of the Architectural or Buildings Branch and be given the title of Chief Architect or Inspector-General of Buildings or Architecture.

(c). The head of a provincial buildings department would be the Chief Architect, with, under him, Superintending Architects, and Executive and Assistant Architects and Engineers, with the district engineer under his control also in cases in which buildings from the Architect's designs are being carried out by him.

(d). Any engineer to hold the position of Chief or Superintending Architect should have had a training in architecture and be fully qualified therein.

3,268. In a province such as Bihar and Orissa, and in view of the fact that building in different circles and districts fluctuate and at times is at a standstill, it would not be possible to form architectural or building circles, hence the necessity for centralizing the designing department of the Buildings Branch at headquarters ; all designs to be prepared therein.

3,269. As occasion arose to erect buildings in various parts of the province, designs would be prepared at headquarters after consultation with the local authorities concerned, and the execution of the work carried out by the Executive Engineer of the circle concerned, the district engineer, or private agency as may be determined, under the control of a Superintending Architect, who would visit the works from headquarters. In the case of important works not being carried out by private agency, Assistant Architects, one or more as required, should be placed in charge of the works under the Executive Engineer or district engineer to supervise the carrying out of the designs on the spot.

3,270. It may be contended that the placing of the Executive and district engineers, as the case may be, when engaged in carrying out buildings, under a Superintending Architect and not under the Superintending Engineer

of the particular circle in which the building is being erected, would lead to difficulties. From my experience on the New Capital works at Patna I am convinced that no new difficulties would arise and that many present difficulties would disappear.

3,271. In the case of works carried out by private agency, the control should be in the hands of the Superintending Architect with an Executive or Assistant Architect, as required, in charge of the actual work.

3,272. In order to develop the building trades, and to make buildings a centre for training in them, I would suggest that thoroughly qualified clerks of work or foremen, master-workmen at their particular trades, should be brought out from home, attached to headquarters, and employed on the various works in different parts of the province as occasion may arise. I cannot over-emphasize the importance of this latter recommendation. If any progress is to be made in the building crafts and trades, and the Indian workman is to be given a chance of getting a thorough knowledge of the trades and developing, as I know from experience he can and will, if given the proper instruction and encouragement, something on the lines suggested must be done.

3,273. Foremen or master-workmen in the following trades should be sufficient at the beginning :—

Brick-laying,
Carpentry and joinery,
Plastering,
Painting,
Plumbing.

These men should hold positions over overseers, sub-overseers and other subordinates and take in hand the practical training of the latter in the crafts and trades of building. Their assistance in the preparation of estimates would tend to greater accuracy, as being practical men, thoroughly conversant with their trades, material and current prices, guess work would disappear. At present all estimates for buildings designed by me are prepared in my office by a staff of estimators, not conversant with practical building and in most cases with no experience thereof.

3,274. The present system of working from type plans should, with the exception of those cases in which local conditions render possible the use of such plans, be discouraged, and the standardization of details substituted. In a large province like this one, where local and climatic conditions vary to such an extent, it is not desirable to use type plans which cannot possibly be designed to fulfil all conditions at all times in different parts of the province. The attempt to do so frequently leads to delays, wastage of time and materials in the preparation of plans, and when insisted upon, not infrequently to dissatisfaction on the part of those who have eventually to occupy the buildings in question. Even in schools, type plans can only be used for the smaller ones, whereas a standardization of all details and fittings is feasible and is the system adopted by the London County Council in their Buildings Branch.

3,275. In conclusion, I wish to state that it is desirable that all Architects recruited for the Buildings Branch should be Fellows or Associates of the Royal Institute of British Architects.

MR. J. F. MUNNINGS called and examined.

3,276. (President.) The witness stated that he was the Consulting Architect to the Government of Bihar and Orissa and that he had had seven years' service. He had been recruited in England by the Secretary of State on a five years' agreement which had been extended for a further period of five years.

3,277. He considered that the Architect should be responsible for the construction as well as the designing of buildings as was the practice in other countries. His

connection with the New Capital at Bankipore had been rather exceptional, as he had a great deal to do with it. His office had been transferred to Bankipore about two years previously, during which time he had been in constant touch with the work in question, and had recently been re-transferred to Ranchi. He had not held executive charge of the construction of the New Capital and accordingly had not issued any orders but the entire details in connection with the construction of the Secre-

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[Continued.]

tariat, High Court, Government House, Post and Telegraph Office and residences generally had been worked out in his office, including the preparation of estimates and the taking out of quantities and indents for fittings.

3,278. His scheme contemplated the entire reorganization of the Buildings Branch and the eventual employment of Architects in a controlling capacity, as the carrying out of large buildings of a distinctly architectural character was beyond the powers of the Department to handle owing to its lack of training in architecture and the building trades. He advocated the establishment of a central office for all designing work, since he considered it was absolutely essential in view of the varying conditions in the country. The objection to the centralization of all designing work was that an Architect or other individual could not properly design a building to suit a particular site unless he had actually seen it and was cognizant of the local conditions with regard to materials, etc., and this was exactly what he desired to ensure. He had recently been to Bhagalpur and Muzaffarpur to inspect sites connected with the schemes he had in hand, but he had not had the opportunity to do so from the very commencement, as under present conditions most of his time was spent in the Secretariat. Another reason for his inability in this direction was that he did not deal with a large number of schemes at the stage when the sites and classes of materials were under consideration. As a result, in the case of the college at Bhagalpur, a great portion of the site had been rendered unavailable owing to the decision to manufacture bricks at site without reference to the building programme. His own experience at Bankipore has been that he had to recast many schemes which had been partially worked out. The designs, etc., of the Ranchi Lunatic Asylum, he thought, had been worked out in the Chief Engineer's office in Ranchi, and forwarded to the Government of India. They were, however, sent back to him for revision which would have been avoided had he been consulted in the first instance.

3,279. He desired to assume general responsibility for the entire construction of important buildings, but did not wish to exclude the engineer. He believed that the Architect in every other country carried out his own construction. This was not only fair to the Architect but in the interests of the work. A great deal of work in connection with the construction of scattered buildings came to him which, he thought, could be dealt with in the local office. It was not necessary for him to prepare designs for small police buildings, hospitals, etc., and all unimportant building designs which had reference to type plans could be drawn up in the local office.

3,280. There was at present a great deal of building work in progress in Bankipore with which he had been connected from the commencement, and he thought that such buildings should be comprised in a separate division under the direct charge of the Architect, and such a system would be preferable to the present one under which the Architect's duties were merely advisory. Other centres where large building works were contemplated were Muzaffarpur, Bhagalpur and Cuttack where colleges, costing Rs. 4½ lakhs, Rs. 8½ lakhs and Rs. 11 lakhs, respectively, were to be constructed as soon as funds were available, the designs for which had been prepared in his office.

3,281. Under existing arrangements, plans had been prepared in his office by himself, two Assistants and a staff of Indian draughtsmen; both these Assistants had joined the Indian Army Reserve of Officers. It was absolutely essential from his point of view that an Assistant Architect should be posted to each important work when it was commenced in order to interpret the drawings, as the misinterpretation of drawings occurred frequently in cases in which an Architect did not have the opportunity of visiting the work for the purpose. Under present conditions such an officer would, of course, be under the orders of the Executive Engineer. An Assistant Architect from his office had been placed on special

duty in connection with the construction of the High Court, and many of the designs and drawings which had been obtained from Allahabad were recast by that officer.

3,282. The Assistant Architects he proposed should be recruited from England and have the same status and pay as Assistant Engineers with the same opportunities for promotion to higher grades. Men who possessed great experience would be required for the supervision of important works. Though an Assistant Architect would ordinarily not be able to assume control of a building of the size of the Secretariat at Bankipore, yet such an officer would be of great help in connection with the interpretation of drawings. He was in favour also of the recruitment from England of clerks of works, and mentioned that a great drawback at present was that building trades did not exist in India as in other countries. Journey-men tradesmen could not be obtained, one result of which was that Chinese and Punjabi carpenters were employed for the wood-work in buildings. No wood-workers of any value other than those belonging to these two classes were procurable. He recommended that the pay of clerks of works should be between Rs. 300 and Rs. 400 a month, and that the terms of their agreements should be perfectly clear. The disadvantage in recruiting European subordinates was that they could only be retained in centres where they had their own society, e.g., by the railways, where subordinates formed a large community. It was not possible to obtain workmen in India in the several trades as there was nobody who could teach them. For the construction of the Secretariat building at Bankipore the contracting firm had employed a practical London builder and the high quality of the work was probably due to a great extent to that fact. He had been designated "resident engineer" although he had received no engineering training, but he was conversant with the practical methods of building. He stated that he himself had served in the building trades before he had been appointed, and that it was the knowledge which he then acquired that was lacking in India, particularly among subordinates who had received their training in engineering colleges solely.

3,283. The clerk of works, or master workman of each particular trade, was the only class of man who could give the necessary practical instruction to enable the Indian *mistri* to obtain the pay Chinamen were at present receiving. He did not favour the employment of Chinamen in India and he considered such employment was the birthright of Indians. He was also of opinion that the Indian was unlikely to learn from the Chinaman as the latter was antagonistic to the former and the two races would not work in concert.

3,284. The witness advocated the standardization of the details in designs to a certain extent and explained that the class of doors and windows of the Secretariat or Post Office buildings at Bankipore could with advantage be introduced in all the buildings in the New Capital of an office class. He added that the present tendency to work from type plans was a mistake except in the case of small buildings, e.g., police stations and schools, etc. The original intention in the case of the three colleges he had already referred to was that the plan for the Cuttack college should be utilized in each of the other two cases, but when meetings were convened for the purpose of collecting information it was found that the sites, entrances and class of rooms and requirements generally all differed considerably. It was possible to standardize details for the three buildings in question and he was at present engaged on this. It was, however, impossible to use the Cuttack plan for the other two buildings.

3,285. He was of opinion that the recruitment of Architects should be effected gradually and that such officers should work their way up more or less as Executive Engineers did at present, and was not in favour of their separate recruitment. It would be necessary for the present to recruit Architects from Europe as India

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[Continued.]

afforded no field for such recruitment. It was true that architectural classes had been started in Bombay, but men in India could not obtain the training procurable in England or elsewhere. He also considered that the future Architects recruited for the Buildings Branch of the Public Works Department should have actual experience as clerks of works and practical experience in a good Architect's office, in addition to the diploma of Fellow or Associate of the Royal Institute of British Architects, as the latter ensured a common bond as Coopers Hill did in the case of the Public Works Department, but he admitted that a degree did not indicate a man's practical qualifications. The majority of the Architects at present in India had practised in England or elsewhere but several of the Assistant Architects had had no practical experience whatever. If an Architect were obliged to obtain his practical experience in India it would be rather unfortunate, as the buildings in India were of an exceedingly simple and elementary character affording no facilities for the study of trades.

3,286. With regard to the age at which Architects should be recruited, he was of opinion that if the intention was to retain the Department more or less as it existed at present, Assistant Architects should be brought out on an equal footing with Assistant Engineers and allowed to work their way up. On the other hand if more experienced and senior men were required their status should correspond to that of an Executive Engineer or Superintending Engineer as the case might be. He added that if the present conditions were to hold good Architects should be recruited on a permanent basis, and that he personally preferred that all posts, provided that the principle was applied to all government departments, whether they were held by Architects or not, should be temporary. He had no complaint to make with respect to the provident fund, and had no particular ambition to be made permanent.

3,287. Assistant Architects should gradually take the place of Assistant Engineers and be Associates of the Royal Institute of British Architects, and their pay should not be less than that of Assistant Engineers who, in no respect, possessed superior qualifications for the designing and carrying out of building works.

3,288. Indian practitioners in architecture could not be obtained until such had been trained by Europeans, and many of those who were in practice at present had been trained in England. The establishment of an Indian school of architecture would enable the Indian to take to the profession, but it was essential that the school should be staffed by Europeans at first. If a suitable architectural school was started in Bombay or elsewhere recruitment could eventually be made therefrom, but for the present men who had received training abroad should be given the preference.

3,289. (Mr. Cobb.) The foremen, or master-workmen he proposed to recruit from England should be required to give instruction in addition to the performance of their ordinary duties and be given the higher subordinate posts and placed in charge of overseers who would receive their share of instruction. A number of the present overseers were wholly unfitted for their work so far as actual building construction was concerned, as they knew nothing about building trades. As they were willing to learn they would soon acquire the necessary knowledge under a working foreman who would give him instruction at the building actually under construction. In places where there were colleges, it would be beneficial to allow the students to visit buildings under construction to enable them to acquire knowledge.

3,290. An engineer could not interpret an Architect's drawings because of his not having received the necessary training. The engineer made just as good a hand at the work of the Architect as the latter, without the necessary training, would at the work of the engineer, e.g., irrigation, railway, harbour works, etc.

3,291. (Rai Bahadur Ganga Ram.) Some of the details in connection with the construction of the Secretariat

building at Bankipore might have been better. For instance the coiling of the room in which the Committee held its meetings was much lower than he had originally intended, his plan and design for that room not having been accepted by the engineer who was attached to his office. There was actually nothing wrong with the room with the exception that the ceiling was low and the columns 16 to 18 inches lower than he had originally intended.

3,292. He advocated the centralization of Architects in order to enable them to benefit by the advice of the Consulting Architect to the Government of India, but thought that if the latter officer were to hold the position of Director General of Architecture his duties should be purely advisory. There was no objection to the scrutiny of designs by the Consulting Architect to the Government of India provided the designer had a fair say in the matter. He had practically no connection with the Consulting Architect to the Government of India at present. None of his designs required the approval of that officer, but he sometimes consulted him unofficially.

3,293. The throwing open of work to private architects in place of Government Architects would eventually commend itself, but it was necessary to secure private practitioners in the first instance. This view was really opposed to his interests as a government servant.

3,294. He had not specialized in Indian architecture. Architecture in India was regarded as a branch of engineering, but, as a matter of fact, structural engineering was likewise a branch of architecture. Hence an architect who combined his knowledge of architecture with that of engineering would be foremost in his profession. There was no objection to the deputation to England of engineers, with evidence of a feeling for architecture, of 10 years' service for the purpose of specialization in different subjects, one of which was architecture.

3,295. The defects in the secretariat building were not due to the paucity of his advice, but to the overseers and others employed on its construction not being conversant with the drawings; they did not, as a matter of fact, understand the elements of architecture. The plastering of the walls of the room in the building to which he had referred was necessary on account of the inferior quality of the bricks used. By this he meant their finish not their strength. If mouldings crumbled away after 10 or 12 years they would be repaired in the ordinary way by the Public Works Department.

3,296. (Mr. Mackenzie.) He had not been officially responsible for the actual construction of the secretariat building, although all drawings, details, estimates, quantities and indents for special door and window fittings had been prepared in his office. He had an Executive Engineer attached to his office at the time to assist him in connection with the quantities, stresses and strains, etc., but could not induce that officer to accept his suggestions for the roof of the particular room referred to above. This, he thought, was due to bias. As a result, the construction of this room cost more than it would have had it been constructed in accordance with his design. The Chief Engineer was officially responsible for the secretariat building, but if any mishap had occurred he would have been held responsible indirectly and blamed accordingly. In the circumstances he considered that the architect should be responsible for the structural stability of buildings.

3,297. (Sir Noel Kershaw.) The builder who had been employed by the firm which constructed buildings in the New Capital had been posted to Bankipore since the commencement of work, and his presence had resulted in a distinct improvement in the work of all those who had seen his methods, particularly in the case of the overseers, who, as they had the opportunity, took advantage of it. Hence similar opportunities should be afforded by the employment of such men. As far as he was aware the builder he had referred to had been employed by the firm for only a few months prior to the commencement of the work in the New Capital.

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[Continued.]

At Bankipore, Friday, 23rd March 1917.

PRESENT:

F. G. SLX, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANOA RAM, C.L.E., M.V.O.

G. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member:—

W. S. BREMNER, Esq., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary).

F. WALFORD, Esq., A.R.C.S., WIL. EX., Principal, Bihar School of Engineering and Inspector of Technical Schools, Bihar and Orissa.

Written Statement.

3,298. The school comprises three sections:—The overseer and sub-overseer section, the vernacular surveyor's section and the artisan section. The two former have been established about 20 years, but the artisan section is a recent addition. Admission to the overseer and sub-overseer classes combined are limited to 60 and in the surveyor's class to 40. Admission to the artisan classes are made at any time as vacancies occur. The present strength of the classes is as follows:—

Sub-overseers	First and second year	77
Overseers	Third and fourth year	32
Surveyors	First and second year	20
Artisan apprentices . . . . .	.. .. .	25

Total in the school . 154

3,299. It was formerly thought by many people that Bihar possessed no capacity for engineering work. At the time when I assumed charge of the school in the year 1900 a former district engineer of Shahabad remarked to me that no good ever had, would or could come of the school. Somewhat similar opinions were held by many engineers in Bihar at that time. Their opinions were doubtless based on their experience, and, having regard to the then prevailing conditions, were possibly not ill-founded but, from a close observation of the character and capacity of the average Bihar, I concluded that, given a sound training, he could hold his own on equal terms with his competitors from Bengal, who at that time monopolized the subordinate engineering services of the Public Works and district boards in this part of India.

3,300. The future success of the school rested almost entirely on my ability to establish the accuracy of my views and it was mainly to do so that, in my letter to government, No. 248, dated the 22nd March 1906, I advocated the creation of a central board of examiners for all the technical institutions included in the old Province of Bengal, with the result that the present Joint Technical Examination Board was created. Biharis have since then been furnished with certificates of equal value to the one of their competitors.

3,301. A system of practical training to follow the school career of candidates for the upper subordinate certificate was introduced by the writer in the year 1905 in order to prevent the rejection of Biharis for employment on the score of inexperience. The benefit of the training was immediately evident and it established beyond doubt that Biharis can be, as many now are, perfectly efficient and reliable subordinates. This is proved also by the results of the competition which is held annually by the Public Works Department for recruiting their subordinate establishment: students of this institution have frequently secured high places on the list of competitors, many of whom were B. E.'s from Sibsagar. On seven occasions they have headed the list of subordinate candidates.

3,302. The system of practical training is as follows:—After completing the school course (four years) students

are placed out under Executive and district engineers for a final year to gain experience on actual work of construction. They receive no pay from the officers they serve but are supported by stipends given by government. The final or upper subordinate certificate is not awarded until after the completion of training and then only provided a favourable report is forthcoming from the engineer under whom the training is served. The value of the training is recognized both by engineers and by the students, and no difficulty is experienced in inducing the former to take them. Every student who has undergone such training, during the nine years the system has been in action, has secured remunerative employment. Further development on these lines is proposed in the school improvement scheme referred to below; the school course is to be reduced to three years and the period of practical training increased by a year. Sub-overseers also are in future to undergo a similar year of training.

3,303. The students on leaving the school find employment as upper subordinates, overseers, sub-overseers, draught-men, estimators, surveyors and as artisans and motor mechanics. All the students who qualify in the overseer, sub-overseer, and artisan classes quickly find comparatively well paid employment, but the students of the vernacular surveyors' class are not so successful. The reason is that the Settlement Department take but few of them, that department having its own system of recruitment and training. From other employment they are often barred by their want of knowledge of the English language. An abstract statement showing the employment of passed students is annexed herewith. (Annexure A.)

3,304. The Bihar School of Engineering cannot be said to be popular with students in this district. Candidates have never been numerous and it is only within recent years that the full number of admissions has been made to the overseer and sub-overseer classes; the surveyor classes have never yet been filled. As a rule students defer a decision as to what profession they intend to adopt until they have passed the matriculation examination. The large majority, including the most intelligent, seek to enter the colleges, and it is from amongst the remainder that most of our students are drawn. It is usually a matter of chance what profession a boy adopts; in the case of a poor boy a scholarship given by a district board is often the deciding factor in inducing him to enter this school. Those who do come are not wanting in intelligence and capacity, but most of them have no love for the work which is displayed by a want of energy and an unwillingness to undergo the drudgery of the initial stages when "going through the mill."

3,305. The chief causes of the unpopularity of the engineering line are due to:—

(a), Caste restriction involving a disinclination to engage in any profession which entails working with the hands.

(b), The supposed superior status and prospects of the legal and other "luck coat sitting down" professions.

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(c). The fact that engineering and industrial enterprise are of comparatively recent introduction into India.

These restrictive causes are slowly losing force, and as they do so the technical schools and colleges will doubtless attract more students from the higher social classes.

3306. Recruitment from the industrial classes is practically non-existent. This, in the writer's opinion is to be regretted, but until the spread of elementary education widens their outlook and enables the most enterprising from amongst them to emerge from the mass, we are not likely to see many positions of responsibility filled by men whose vocation is most closely allied with engineering work.

3,307. All industries are based upon the industrial classes and it would only be beginning at the beginning if their education, both elementary and technical, were seriously taken in hand. Practically nothing has yet been done. Attention is invited to a system of training in connection with the artisan classes which have recently been introduced into this school. A note on the subject is annexed. (Annexure B.)

3,308. It will be understood from the above that in my opinion the most suitable candidates in this district are not attracted to the profession. The fault does not lie with the system of technical education in force. Under existing circumstances the only thing possible is to make the best use of those who do come forward and endeavour to improve the training given in the school by making it as practical and as thorough as possible.

3,309. The training at present given in this school is suited to students who are eventually to be engaged as subordinates on engineering work, apart from building. It should suffice for the needs of private enterprise as well as the Public Works Department. Students who have undergone the course are usually successful in after life; failure sometimes occurs but it is more often due to defect of character than to want of professional knowledge.

3,310. I would advocate the division of the Public Works Department into two branches, one concerned with engineering and the other with building. The latter should contain officers who have been trained in builders' work, amongst whom there should be a proportion of Architects. This change would involve

the training in the schools of subordinates qualified to supervise builders' work, and this class of subordinate would be more suitable for employment by contractors engaged on such work. It would not be possible to add this instruction on to the existing course for overseers.

3,311. There are at present no facilities for the training of engineers in this province. Recruitment is, I understand, to be made from the Roorkee Engineering College. Seats are reserved for students from Bihar in the Civil Engineering College, Sibpur, but they usually remain vacant. Biharis are loth to leave Bihar.

3,312. The question of raising the status of this school to that of a college has several times been raised, but the number of appointments in the province is not sufficient to warrant the expense of the maintenance of a college.

3,313. A scheme for improving and enlarging the Bihar School of Engineering was drawn up by a special committee appointed by government in 1913 and is now under consideration by the Government of India. It is proposed to develop the school on its present lines, more attention being given to practical work than at present. Classes for the training of draughtsmen, estimators and permanent-way inspectors are included in the scheme.

3,314. Sibpur College have for several years turned out many more B. E.s than can find employment and, as they are obliged to accept service as subordinates, the interests of legitimate subordinates have suffered in consequence both in Bengal as well as in Bihar. Since the separation of Bihar into a separate province appointments are confined to the natives and residents of the province.

3,315. There are four engineering colleges in India, all engaged in training civil engineers. Except in the case of the Roorkee College most of the men trained do not find employment as engineers but as subordinates. In my opinion four colleges are altogether more than are necessary and their maintenance not only does harm to the existing body of Indian engineers and subordinates but it represents so much waste of government money. I support the view that one imperial civil engineering college would suffice. The others might be converted to colleges specializing in electrical and mechanical engineering, mining, etc., or they should be abolished.

ANNEXURE A.

Statement showing the employment of passed overseer and sub-overseer students, 1901—1916.

EXCLUDING AMINS AND SERVETORS.

EMPLOYMENT.	As upper subordinates.	As overseers.	As sub-overseers.	As estimators.	As draughtsmen.	As surveyors.	As assistant settlement officer and Amungosa.	Miscellaneous.	Total.	REVENUES.
	Salary Rs. 80—100 and upwards.	Salary Rs. 60—80.	Salary Rs. 30—65.	Salary Rs. 30—80.	Salary Rs. 40—100.	Salary Rs. 25—100.	Salary Rs. 80—160.			
1	2	3	4	5	6	7	8	9	10	11
Public Works Department	25	4	60	11	5	12	2	..	109	
District and Local Board	16	17	58	3	1	4	..	..	98	
Municipality	11	9	8	..	12	3	..	..	34	
Railway	3	..	4	..	12	3	..	..	11	
Company, Estate and Raj	7	6	5	..	..	12	..	..	20	
Miscellaneous employment	3	..	..	..	..	..	1	2	7	
Teachers	3	7	..	..	..	..	..	..	10	
Untraced	25	..	..	..	..	..	..	..	35	
Unemployed	7	..	..	..	..	..	..	..	7	
Deceased	13	13	
Undergoing practical training . .	10	10	
TOTAL	132	43	135	11	11	13	3	3	354	

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[Continued.]

ANNEXURE B.

BIHAR SCHOOL OF ENGINEERING.

Note on the Artisan Class.

Classes for the training of artisans in the school workshops were started in 1913. They have proved so successful that it is desirable to consider the question of enlarging them.

Particulars of the classes are as follows :—

Boys, preferably sons of artisans, are admitted who are above the age of 12 years provided they are able to read and write. In addition to a trade all are taught practical drawing and workshop arithmetic. The instruction is given in the vernacular.

At the discretion of the Principal, members are paid stipends up to a maximum of Rs. 10 according to the skill attained. The stipend list is revised every half-year and stipends are re-allotted according to progress made in workshop and in class. In addition to his stipend each boy is credited with half the value of his earnings, which sum is paid to him upon the satisfactory completion of his full course of training. The amounts are kept in the Post Office Savings Bank. If an apprentice leaves before completing his course the whole amount standing to his credit is forfeited. Apprentices must attend the school until they are proficient, the time taken being from three to four years. Those who show no aptitude for mechanical work are dismissed at any time. Boys who become proficient at motor repairing are placed out with car-owners for a final year to gain experience. No certificate is given until a favourable report is received from the car-owner.

The cost of the classes amounts to Rs. 2,900 per annum, excluding the cost of instructors, but as the income from the proceeds of sales and work done amounts to about Rs. 8,000, the classes are self-supporting.

Applications for admissions are received almost daily and many candidates are willing to work without wage in order to get a footing and await a vacancy on the stipend list; a few such are taken, but owing mainly to the want of additional supervision it is not possible at present to accept more for training.

The following is the present and proposed strength of the classes :—

	Present.	Proposed.
Motor mechanics	10	15
Carpenters	5	8
Fitters and turners	5	10
Blacksmiths	5	5
Moulders	0	4
Painters	0	3
Total	25	45

The Bihar School of Engineering Committee which met in April 1913 to advise government regarding the development of the school, considered the question of the artisan classes. They advised that provision should be made for 50 artisans in the above trades and that there should be a class also for tinsmiths and sheet-metal workers. The committee proposed at the same time that the workshop accommodation should be increased and that there should be three foremen-instructors, two Europeans and one Indian.

An additional workshop was built last year so that the shops are now of the size recommended by the committee, but no additional foreman has been appointed. Application has been made for the appointment of an additional man, but government have deferred the case on financial grounds.

Owing to the introduction of the lump allotment system for the payment of *mistris* and of an improved system which allows of more work to be undertaken in the shops, no additional instructors would be required for enlarging the classes to the extent proposed above, but it is indispensable that additional supervision should be available. The present foreman is supposed to be responsible for the practical training of all the students in the school, numbering about 160, and in addition to manage the shops, stores, electric generating plant, etc. It is, of course, not possible for one man to perform efficiently so many duties and much of the time of the Principal is absorbed in the details of the workshop instruction. The carpenters' and paint shops are entirely managed by the Principal.

MR. F. WALFORD called and examined.

3,316. (President.) The witness stated that he was the Principal of the Bihar School of Engineering and that he had held that appointment for nearly 17 years. The school was under the control of the Education Department, and he himself was a member of that department. He was a mechanical engineer by profession, having served his apprenticeship with a firm of mechanical engineers and subsequently received his theoretical training in the Royal College of Science, of which he was now an Associate.

3,317. There was a joint course in the Bihar school for overseers and sub-overseers. A boy who joined the school could after two years pass an examination and get a sub-overseer certificate, while if he continued his studies for two years longer he could get an overseer's certificate. If subsequently he underwent practical training under an engineer and qualified as an upper subordinate he got a certificate to that effect. The boy who only took the two years' course received no practical training. The first two years were thus common to both overseers and sub-overseers but proposals for altering this system had been put forward.

3,318. The educational qualification required for admission was a pass in the matriculation examination in English and mathematics. If a student had not passed in these subjects in the matriculation he had to pass an examination in them, of the same standard, held in the school. There was at present no school final examination in the province. The competitive examination for admission applied only to those students who had not passed the matriculation, those who had passed that examination not being required to undergo any further test. The maximum age for admission to

the school was 20 years while the minimum age for admission to the matriculation was 16; he could not explain why the former limit had been fixed so high. It had been in force for a long time, and he had not found it necessary to propose any alteration. As a matter of fact there had been several applicants for admission to the school who were over 20 years of age, and who had had on that score to be refused admission. The rule did not result in students who had failed in the matriculation for two or three years entering the school, as most of them came in at 17 or 18, the number of those joining at later ages being very limited. The average age of admission was, he thought, about 18. In principle he agreed that it was desirable to get students at a younger age but he did not think it advisable to alter the rules as the larger the demand for admission the more possibility there was of selecting students of a better type as well as of a younger age. At present the number of applicants for admission was insufficient and it was only within the last three years that he had been able to admit the full number of students.

3,319. There was a joint Technical Examination Board for the two provinces of Bengal and Bihar and Orissa. The Chief Engineer, Buildings and Roads Branch, Bengal, was its president and the heads of the three major technical institutions (the Principal of the Sibpur College, the Headmaster of the Dacca School and the witness) in those provinces were its members. A member of the Bengal Public Works Department and a member of the Public Works Department in Bihar and Orissa were also on the board and the Superintendent of Industries, Bengal, was the Secretary. The board held examinations both for overseers and sub-

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[Continued.]

overseers. The students of the Bihar School of Engineering had succeeded in holding their own, and had shown themselves fully up to the average in these examinations. For overseers the examination was held at the end of the four years' course and a certificate was given to those who did not intend to undergo practical training, but the diploma for upper subordinates was not given until after five years, i.e., after the student had completed four years' theoretical and one year's practical training. The majority of the students received practical training and got the higher certificate, only very few taking the overseer's certificate. Overseers' certificates were not given to students who intended to put in a period of practical training, only the higher certificate being given at the end of the full course. The selection of upper subordinates for the Public Works Department was made from among those students only who had undergone the full five years' training.

3,320. A proposal was under consideration to alter the course for upper subordinates from 4 years' theoretical and a year's practical training to 3 years' theoretical and 2 years' practical training and to have entirely separate courses from the very start for overseers and sub-overseers. The introduction of a 2 years' theoretical course followed by a year's practical course for lower subordinates was also under consideration. These recommendations had been made by the committee appointed to advise as to the steps to be taken to improve the Bihar School of Engineering. In place of the practical training under an engineer prescribed at the end of the theoretical course students might undergo practical training in the college workshops during their college course, this training being of exactly the same standard as the workshop course for upper subordinates in the Sibpur College.

3,321. The Public Works Department in Bengal held a competitive examination, full details of which had been given by the Principal of the Sibpur College in his evidence, for the recruitment of their subordinates, the examination being held at Purulia. This system had been inaugurated before the creation of the Province of Bihar and Orissa and students from the Sibpur College, the Dacca School and the Bihar School of Engineering were admitted to the examination. During their year's practical training they received a stipend of Rs. 50 a month, and at the end of it the competition for appointments was held.

3,322. The approximate average cost of education for a pupil in the institute was Rs. 300 a year. A fee of Rs. 1-8-0 a month was charged to both overseer and sub-overseer students residing in the province, and one of Rs. 3 a month to students coming from outside. Students had also to provide their own books. There was a hostel attached to the institution, students residing there paying for their own food. The average expenditure of a student came to about Rs. 20 a month exclusive of the cost of books, instruments and clothes.

3,323. There were 20 government scholarships of Rs. 7 a month for both the overseer and sub-overseer classes and 30 or more scholarships awarded by district boards and ranging in value between Rs. 5 and Rs. 7 a month. A government scholarship was tenable for one year only in a particular class, whereas a district board scholarship could be held for two or four years. He saw no objection to a student holding both scholarships at a time, provided the board had no objection. The number of students in each class varied considerably. At the beginning of a session there was usually a large number but as time passed this number decreased, the average being about 120 students in all classes. The number in the classes at present was 109, this being the end of the session. As there were about 50 scholarships nearly half the students could hold one. This meant that there was a considerable number of scholarships but none of sufficient value to cover the whole cost of a student's education in the school. The question as to whether it was better to have a smaller number of scholarships of greater value or a larger number of scholarships of low value depended upon the class of students attracted to the school, but he would certainly advocate a system

of competitive examination for scholarships of higher values. This would have the effect of improving the keenness of the students, as also their work while in the school.

3,324. The school building was a fine one and quite adequate for present requirements. It had a history attached to it. When King Edward as Prince of Wales came to India and visited Bankipore subscriptions were started for the benefit of technical education in Bihar. About two lakhs of rupees were subscribed but for several years the money lay idle. At that time there existed the Patna Survey School and there was also the Bihar Industrial School. It occurred to the Commissioner to combine these two and start a new school—the Bihar School of Engineering—and to utilise the money which had been lying idle for the purpose. Government agreed to appoint a staff and run the school provided the money above referred to was utilized for the construction of a suitable building. The school was therefore run as a government institution and there was no outside governing body, though there was a board of visitors. The school equipment, which the witness had worked up during the last 16 years, was quite adequate.

3,325. He was not altogether satisfied as to the adequacy of the staff, especially on the workshop side. There was only one European foreman who was responsible for the teaching of nearly 200 boys, as every boy in the school had to undergo a certain amount of training in the workshop. He had to look after not only the overseer and sub-overseer classes but also the artisan class. The witness had therefore proposed, in his written memorandum, an increase in the staff of two extra foremen—one European and one Indian—to bring the number of foremen to three.

3,326. The students of the artisan class belonged mostly to the working class being the sons of *mistris*, etc., and very few were from the *bhadralog* class. They underwent a course of three or four years, depending on the aptitude of the particular boy. They generally completed their course in the school, the school having a considerable hold over them. Part of the wages earned for the work which they did was deposited in the Savings Bank Account which they were liable to forfeit if they left before the completion of their course. It had not been his experience, as was the case in many institutions of this class in other parts of India, that a workman after getting sufficient training to make him a little better than the general run of his class left the school at once instead of waiting to complete his course and become a complete craftsman, and he had provided against this tendency by having a monetary hold over the students. Besides, if they left without permission, they were not given any certificate, without which the training possessed little attraction. The certificate granted by the school was of real monetary value in the case of boys who became motor mechanics. He could not, however, speak about the certificates given to students of the other artisan classes as these had not been in force for more than three years and no considerable number of students had as yet been turned out.

3,327. He did not altogether agree with the evidence given by one of the witnesses that good *mistris*, i.e., practical craftsmen, were almost non-existent in Bihar and that the type of *mistris* obtainable in the United Provinces was very rare in Bihar. In the case of a successful master workman other things besides skill at his trade were required, e.g., business ability and character. As regards skill the witness had no complaint against the Bihari workman, who turned out excellent work if he was made to do so. The fact was however that in the bazaar the work he was called upon to do was of the roughest kind and it was only the European who demanded a better class. With reference to the evidence given before the Committee that the standard of the building trades in Bihar was disgracefully low and that good brick, plaster or painting work was practically unknown in the province, he was of opinion that the Bihari workman required more supervision than the up-country man but that, if good super-

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vision was provided, he could turn out as good work as any other workman in India. In principle he was in favour of the idea of introducing certain master workmen, for instance, bricklayers, plasterers, painters, etc., into the province, with the object of improving the standard in these branches of the building trade, but he had not studied how the services of these men could best be utilized. At present the students of the overseer and sub-overseer class did not go through a practical course of building and only learnt about brickwork through their books, but when the proposed "builders' yard" was established according to the Bihar School Improvement Committee's proposals the boys would learn actually to lay bricks. One had to work with the material available in the school. The boys who came to the school, were mainly from the literary class, who were by tradition averse to practical work. The only possible means of improving them was to make the course as practical as possible.

3,328. (*Mr. Cobb.*) He did not co-operate with the Arts schools in getting students for the engineering school, as boys did not make up their minds before passing the matriculation examination what profession they wanted to take up. What usually happened was that in the first instance, after passing the matriculation, the student went to the Patna College. If he could not get admission there he sought admission to the Bihar National College and on being rejected from there came to the engineering school. If he was not admitted there he joined the medical school. The witness did not send the prospectus of the school regularly to the high schools although he had circulated them for several years. He admitted that he had never made a special effort to secure boys for his school. Generally he thought the headmasters of schools took no interest in the future of their boys, their interests being confined to getting their students through the matriculation examination. He doubted if it would be possible for the headmasters to take a personal interest in their boys as in a high school there were as many as from 300 to 400 students. Occasionally a headmaster might take an interest in one or two of the individual boys in the school.

3,329. He would prefer to have boys at a younger age but at present there was no field for selection and he had to take practically every boy who wished to join in order to fill the school. The problem would however gradually be solved. Other professions such as the law were getting over-crowded and in the near future students would be forced to look to other lines. The number of students in his school was already gradually increasing. It would be thought be possible in the future to make a selection of the youngest, best and most intelligent students for admission.

3,330. He could not say what was the idea in having a large number of scholarships of small value and he did not think that the question had been seriously considered. When the school was started government decided to give 20 scholarships, presumably with the intention of inducing boys to join the school instead of entering the literary colleges. He admitted that scholarships of higher value would be more attractive. The students joining the school were, with some exceptions, not remarkably poor as they did not come from the artisan or the industrial class but belonged to the middle *bhadralog* class. The question of scholarships had also been discussed by the School Improvement Committee.

3,331. He admitted that an artisan who was taught by a master workman imported from England would generally revert to his old style, but he considered that he would not do so completely but would retain at least a certain amount of the instruction received. He would be a better workman than his father and if his son followed the same course the latter would be still better and thus there would be a gradual improvement in the class of work.

3,332. There was no restriction attached as to the utilization of the capital fund of the school, but as the fund was mainly intended for technical education an

artisan class had been attached. The steps that were required to improve the school in regard to technical education were fully explained in the committee's report. Besides the Bihar School there was one school at Ranchi for sub-overseers and artisans. He was of opinion that there should be a school of engineering at Cuttack. A proposal to that effect had been made by the witness and was under the consideration of the Government of India. It was intended to place that school under a European, and to start with the training of sub-overseers with an artisan and a survey class attached. There was ample scope for such a school, as Orissa was in need of overseers and sub-overseers and had to meet the demand from Bengal, Biharis preferring not to leave their own districts. He was not very familiar with the conditions in Orissa but gathered that the Ooriyas would not be so backward in taking advantage of an engineering school as the Biharis.

3,333. (*Rai Bahadur Ganga Ram.*) There was only one government appointment for overseers and two for sub-overseers guaranteed to the Bihar School; no appointment was guaranteed by the district boards.

3,334. A district board scholarship was generally awarded to the student from the particular district which gave the scholarship but occasionally a district board gave a stipend to a student from another district. The boards' scholarships were entirely at the disposal of the boards and the school had no voice in the matter. These were properly speaking stipends; the government scholarships were given for merit alone as the result of examinations and were scholarships in the proper sense of the word.

3,335. With reference to his statement that the students who could not get into the literary colleges joined the engineering school he explained that as a result of this the school did not generally get the most brilliant boys though there had been a few such students and a certain number who had passed the first arts.

3,336. Practically all the boys turned out from his school got employment, the majority in Bihar and a small proportion in the United and other provinces. The average Bihari did not want to leave his province even for Orissa, but the Bihari who had the courage to do so generally got on very well.

3,337. With reference to the suggestion made in his written memorandum that the Public Works Department should be divided into two branches, one concerned with engineering and the other with buildings, he explained that he intended that the General Branch should have nothing to do with the construction of buildings, the buildings which he had seen erected by engineers being of an inferior class as they had not usually been trained for such work. He wanted also to introduce building craftsmen who would be specialists in building work. There was no objection to these men being called sub-overseers, as whoever supervised a building could be designated an overseer or a sub-overseer.

3,338. The subjects which he taught in the school varied considerably, as he generally took up those subjects for which he could not get another teacher. For instance if he found that the machine drawing was poor he took up that class for a year or so. Then he left it and took up another. At present he had under him the carpenters' shop which needed organizing.

3,339. (*Mr. Mackenzie.*) He had a staff of 8 Indian assistant masters, one European workshop foreman and about 12 *mistri* instructors for the workshops. Two of the Indian assistant masters had been recruited from the Roorkee College. All the members of the staff were members of the Education Department and were in permanent service, except the *mistris*. Two of his teachers had had experience in the Public Works Department before joining the school. There was no system under which men were supplied by the Public Works Department for educational purposes to the school and he was doubtful whether such men would care to come to the school. On principle he considered that a man with practical experience was likely to be a good teacher even though he had no experience of

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teaching work, since practical experience was of more importance than experience of teaching, but both were necessary. Such a man would not be appointed permanently to the school, and if it were found that his work was not satisfactory he could be sent back to the Public Works Department. One year's probation would be sufficient to show a man's fitness for teaching. The witness did not, however, approve of the idea of getting men from the Public Works Department for a period of say five years and then sending them back, getting other men in their places for a similar period, nor would the men themselves care for such a system. Men would no doubt have to come to the school if they were required by government to do so, but it would be difficult to get good teaching work done by unwilling teachers. If Public Works Department men were engaged on teaching work they would have to be paid higher salaries as they would be losing a good deal by leaving the Department.

3,340. When there was a vacancy in the school and the Director of Public Instruction wanted to transfer a man from elsewhere the witness had to accept the latter, but there were so few technical schools that men were not available for transfer and generally the witness was required to select a man by advertisement in the press. The man selected was appointed under the Education Department on probation in the first instance. Pretty good men were appointed in this way who were keen about their work and liked it and he had had no occasion to complain about them. On the whole his teachers were willing workers although needing encouragement occasionally.

3,341. The witness maintained a list of passed overseers and sub-overseers, such as that given in his written memorandum, which showed that the number of persons who got private employment was comparatively small. The demand for private employment was not increasing. There was not scope for many more overseers and sub-overseers than were now being turned out by the school. His policy had been to keep the classes very small so that the boys could have the advantage of individual attention. Formerly the passed students of the school had great difficulty in securing employment in competition with men from Sibpur, and he had therefore suggested that the certificates in both provinces should be of equal value. Subsequently examination by the Joint Technical Examination Board had been started as a result of his recommendation which served a useful purpose, and the students of the Bihar School could now get employment in competition with other students. It was, however, no longer so necessary for the school to be connected with this board and the school committee had hence proposed to disassociate the school from it. If the school became more popular and there was a large number of applicants for admission he would not increase the number of students very largely, certainly by not more than 50 per cent., as he did not think that the large number of overseers and sub-overseers turned out would be so successful in finding employment. The supply should not be made greater than the demand.

3,342. (Sir Noel Kershaw.) He did not want to increase the number of his students very largely and his object was simply to get more field for selection. One of his definite aims in running the school had been that the boys who were trained should get employment and he did not want to admit a large number who could not be so provided. The table of passed candidates which he maintained was not published broadcast but was submitted with his annual report. He did not think any useful purpose would be served by circulating the statement to the high schools and to the parents of the students. The school was gradually becoming known, and it was becoming more and more known

that the boy who secured the school certificate was sure of getting employment. No further effort was required to advertise the fact.

3,343. When the new province was formed, witness had anticipated that, his school being the chief institution of its kind in the province, government would immediately require a scheme for enlarging it. He drew up a note putting forth the directions in which the school should be developed and this was considered by government, who then appointed a committee to investigate the whole question. The committee accepted all his recommendations and its report endorsed practically all the proposals he had put forward for the development of the school. As regards the absence of any provision for brick-layers, plasterers, etc., in the school he explained that it had been his policy not to start any class unless he was sure there was a fair chance that the boys who received training and obtained the school certificate would get employment. As he found that there was no such demand for brick-layers and plasterers he had not proposed a class for the purpose. Then again there was difficulty in arranging for their instruction as the school could not afford to erect a building and then pull it down or to plaster and un plaster it in order to teach boys. The same thing did not apply in the case of carpenters, as there was nearly always a good deal of work required by the public which could be undertaken by the boys in the school. In fact there was more work forthcoming in this way than the class could cope with. This class was being run very much on commercial lines, which would not be possible with a brick-layers' class. He admitted, however, that there was some scope for training in brick-laying and plastering.

3,344. (Rai Bahadur Ganga Ram.) Very few boys showed any tendency to become contractors, only those going into this line who belonged to families who were already contractors. Some students had entered with the express intention of becoming contractors but he could not give the number. He did not remember any case of a boy becoming a brick or lime manufacturer.

3,345. (Mr. Bremner.) The scale of fees for the overseer and sub-overseer classes was Rs. 1-8-0 a month for the residents of the province and Rs. 3 a month for outsiders. To attract students from Orissa there were two scholarships for sub-overseers worth Rs. 15 each, which were tenable in the Bihar School of Engineering or the Ranchi School, and there were two scholarships of the same value for the overseer class tenable in the Bihar School. There was one scholarship of Rs. 20 a month for an engineering student from Orissa tenable in the Sibpur College. All the scholarships were not, however, availed of and within the last three years only four or five Ooriyas had joined the Bihar School, there being a great disinclination on the part of the Ooriyas to go so far away from their homes. After passing their examinations most of the Biharis were unwilling to go outside the province and it was only an exceptional man who was prepared to do so. Hence the Biharis would not go to work outside Bihar and the Ooriya would not come to Bihar to be trained. It was therefore essential that there should be an engineering school in Orissa.

3,346. There were eight Indian teachers in the Bihar School. The head assistant got Rs. 250 a month and the others got Rs. 200 a month or less. Fuller information on the point was given in the school committee's report. Upper subordinates in the Public Works Department were disinclined to leave the regular line and join the school as they could make a good deal of money over and above their pay in the Department.

E. C. RYLAND, Esq., Inspector-General of Police, Bihar and Orissa.

Written Statement.

3,347. (I.) Economy and suitability of methods of execution of public works.—Police buildings are constructed according to standard designs. The buildings are of two classes,

(i) those the cost of which is estimated to exceed Rs. 2,500 and the construction of which may be undertaken only by the Public Works Department and must be borne on the books of that Department;

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(ii) those the cost of which is estimated at Rs. 2,500 or less and which may be constructed either departmentally or by the Public Works Department. Although the practice of employing the police to construct their own buildings has been strongly and universally condemned, the tendency has been to extend the powers of the police in this direction. It is only in recent years that the cost of buildings that may be constructed by the department has been raised from Rs. 1,000 to Rs. 2,500. The main reasons why this has been necessary are:

(a) that police buildings have to be constructed in out-of-the-way places where the Public Works Department are unable to exercise control or make arrangements for labour and materials;

(b) that the Public Works Department do not undertake to construct buildings in the manner in nor of the materials with which police buildings are constructed;

(c) the demand for buildings is so great and the annual grants so limited that the police have to resort to the poorer class of building as the only possibility of securing quarters of any kind in certain localities.

The disadvantages of having departmental buildings, apart from the great objection of taking up the time of officers in supervising the construction to the detriment of their legitimate duties, are that—

(a) after construction the buildings remain on the police books and all repairs have to be undertaken by the department;

(b) being roughly constructed and under no expert supervision repairs are constant and, in the long run, cost more than properly constructed buildings, while the accommodation is indifferent and insanitary.

(2) I am strongly of opinion that the police should be relieved of all duties and responsibilities in connection with buildings. The system of getting district engineers to supervise the construction of police buildings has been tried with indifferent results, and has considerably added to the cost of the buildings. Under existing arrangements the divisional Executive Engineers cannot be expected to supervise the work of minor constructions in outlying places nor would it be possible for them to secure labour or collect materials for such works. My own idea is that the Public Works Department should have a separate construction staff for each division. This staff should have no fixed headquarters but should move from place to place where buildings are under construction. A programme of districts to be visited should be drawn up and all departments requiring roads or buildings in such areas should be required to secure sanction for their construction. It will thus happen that, instead of having one minor work to supervise, the staff will ordinarily be several minor and major works, which will not only fully occupy the staff but will also attract contractors whom it would not pay to take up any one building but who will find it well worth their while taking up the contracts for several works. The difficulty of securing materials and labour would thus be obviated. I do not see why the Public Works Department should not undertake the cheaper class of buildings as well as the more expensive. I think if the cost of the supervision was divided up amongst the several departments employing the construction staff, the cost of supervision should not be heavy.

(3) The budget for next year provides a grant of Rs. 7,87,968 for roads and buildings of 14 different departments and in 18 different districts in the province. To this should be added buildings to be constructed departmentally. It would probably not be possible at this stage to group the above works and have them taken up by the construction staff in different areas, but apart from the projects sanctioned there are no less than 154 projects which have received administrative sanction which are pending the allotment of funds. All are more or less of equal importance and I can see no reason why they should not be grouped by areas and a programme of construction arranged. The construction staff would thus be occupied for several years to come, and as at present, at least so far as the Police Department is concerned, the demand for buildings

far exceeds the number annually sanctioned, it will be a considerable number of years before the services of the construction staff could be dispensed with. I venture to think that if relieved of construction work the existing Public Works Department divisions might be doubled up or at least extended so as to set free a certain number of officers who could be employed on the construction staff.

3,318. (II.) Encouragement of other agency.—I am quite convinced that it would not be possible or desirable to entrust construction work and the upkeep of certain classes of public works to any private agency. Such private agencies do not exist in the *mofussil*, and even in the larger towns of this province there exist no recognized and well established firms. The Indian contractors are usually foreigners, men possessing no capital and no command of labour. It may be that in time to come, if construction work is grouped as contemplated in the earlier part of this note, it may attract the larger firms in presidency towns or lead to the establishment of firms in this province, but I am quite certain that it would never pay any firm to take up work under present conditions where odd buildings are constructed in different and widely separated localities.

3,319. (IV.) Relations with other departments and sub-branches.—So far as the police are concerned, we have no complaint to make regarding our relations with the Public Works Department, though I fear it cannot be said that the existing system is conducive to economy or to rapidity. The only remedy for this that occurs to me is that outlined in the earlier part of this note.

3,350. (General.) Every project has, under the existing rules, to pass through three stages in the order given below:—

(1). Administrative approval.

(2). Preparation of and sanction to detailed plans and estimates.

(3). Financial provision.

The last stage does not keep pace with the two former with the result that we have long lists of works which have been approved and for which plans and estimates have been duly passed but which remain pending for years for lack of funds. The present unsatisfactory state of things is no doubt due to the fact that this is a newly created province and to the financial stringency on account of the war, but even in normal times I venture to think the existing procedure unnecessarily cumbersome.

(2). As regards police buildings, when a Superintendent requires an ordinary building to be constructed by the Public Works Department or requires additions or alterations to the buildings already borne on the books of that department, which additions or alterations are likely to cost more than Rs. 5,000, he proceeds as follows:—

(a) Obtains the sanction of the Inspector-General to submit the plan and rough estimate of the work required.

(b) Sanction of the Inspector-General having been obtained, the Superintendent submits a requisition to the Executive Engineer for the preparation of a preliminary report and rough estimate of the cost of the work, together with such general plans and sketches as may be necessary.

(c) The Executive Engineer then prepares a rough estimate and plans. These are submitted to the Superintending Engineer and, after having been passed by him, are forwarded to the Superintendent of Police. The Superintendent then submits his proposals, through the District Magistrate and the Deputy Inspector-General of the Range, to the Inspector-General.

(d) The Inspector-General then goes up to government for administrative approval.

(e) The administrative approval having been accorded, the Public Works Department is called on for the preparation of detailed estimates and plans.

(f) Finally, the project is sent up and remains pending the allotment of funds.

(3). It occasionally happens that the project is dropped between the 3rd and 4th stages. It also happens that the difference between the rough estimate and the final

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estimate is so great that fresh administrative sanction has to be obtained. It appears to me that much unnecessary labour might be saved if the heads of departments could be advised roughly of the amount in the Public Works Department budget that is likely to be allotted to their respective departments for major works during the coming financial year as is done in the case

of grants for minor works. It would no doubt be necessary to keep a reserve for emergent works, but ordinarily it should be possible to give heads of departments some idea of amounts likely to be allotted and the preparation of projects could then be regulated in accordance with the probable grants.

MR. E. C. RYLAND called and examined.

3,351. (*President.*) The witness stated that he was officiating Inspector-General of Police, Bihar and Orissa.

3,352. Under the present procedure the Police Department constructed and maintained police buildings which cost Rs. 2,500 or less, irrespective of their situation. Ordinarily, additions to buildings constructed by the Public Works Department were done by that Department, but the practice applied also to cases in which the Department wished to construct quarters or stables or other additions costing Rs. 2,500 or less alongside a permanent police station which had been constructed and was maintained by the Public Works Department, provided the new work did not constitute an addition or alteration to any existing building. As the result of this system, which he did not think was particularly disadvantageous, buildings constructed and maintained by the Public Works Department might adjoin those constructed and maintained by the Police Department. He agreed, however, that if the Public Works Department had occasion to send an overseer to repair a particular building that subordinate could equally well repair a police building alongside, and remarked that the present system was unique and that he was strongly of opinion that the Police Department should be relieved of all its duties and responsibilities in connection with their buildings.

3,353. He stated that the Public Works Department were usually not prepared to undertake the construction of police buildings in the manner, and with the materials, sometimes desired by the Police Department. The former Department constructed buildings with first-class bricks and mortar and the latter with third-class bricks and mud. The latter class of buildings were termed *kutchi pucca* and their plinths were generally of mud, the posts used being rough instead of proper posts, and the roofs were constructed with raw timber which was thatched over. The Public Works Department could not construct buildings in out-of-the-way places. The special orders of government had to be obtained for the construction by the Department of police buildings which cost Rs. 2,500 or less. On the other hand the Public Works Department were not prohibited from undertaking the construction of a *kutchi pucca* building which cost more than Rs. 2,500 and in such cases the class of materials to be utilized and the manner of construction were left entirely to the Public Works Department.

3,354. Police stations were constructed on standard plans and the Police Department had been consulted when the latter were first framed.

3,355. Buildings constructed by the Police and Public Works Departments were repaired by these respective departments. His main objections to the construction and repair of buildings by the Police Department were that it interfered with the more legitimate duties of the police and that the department did not possess the necessary skilled agency. The present procedure was also undesirable as it was liable to abuse. Local *zemindars* were often called on to provide materials such as posts and bricks. For these reasons he advocated the transfer of such work to the Public Works Department although it involved a larger expenditure by doing so, by reason of the fact that the Police Department spent a great deal on repairs, and in the long run the cost of construction of buildings by the Police and Public Works Departments would be about the same.

3,356. He had not effected a comparison of the cost of the repair of buildings by the Public Works and Police Departments respectively.

3,357. Rs. 50 and Rs. 100 were allotted for the annual maintenance of police outposts and the larger stations respectively and a sum of Rs. 200 for buildings in the Reserve. Petty repairs only could be executed with the money thus allotted, with the result that though buildings could be kept going with such repairs perhaps for several years the buildings eventually came down. If more money was set aside for annual repairs the buildings would perhaps be serviceable for a longer period, but the present repair allowance was not sufficient. He was not aware of the actual percentage of repairs to the capital cost of police buildings, but believed it was a very low figure. He would emphatically object to the departmental system of repairs even if a larger allowance was made for repairs as the system absorbed a considerable amount of the time of the Police Department.

3,358. The supervision by district engineers of the construction of police buildings had been tried with indifferent results, and had led to a considerable increase in the cost of buildings, as such officers charged $3\frac{1}{2}$ per cent. on the cost of buildings in cases in which they did not prepare the plans and estimates, and 7 per cent. when they did, that is, 7 per cent. more than the cost of buildings constructed by the Police Department. The estimates of the Public Works Department, on the other hand, allowed about 5 per cent. for establishment charges and 10 per cent. for contractors' profits, the latter charge was, however, not recognised as such by the Police Department. But he was unable to state definitely what the comparative cost of buildings constructed by the district engineer and the Public Works Department, on behalf of the Police Department, amounted to. In his opinion no material benefit had been gained by the employment of district engineers in connection with the construction of police buildings, and the Police Department had constructed buildings themselves equally well if not better. The standard of work carried out by the district board was lower than that of buildings constructed by the Public Works Department and probably would be even for the same class of buildings, but it had to be remembered that the Public Works Department did not construct buildings under the same conditions as district engineers; if they did the work of the Department would not perhaps be better. By this he meant that the Public Works Department employed large contractors and used special brick kilns for the manufacture of bricks, whereas for buildings departmentally constructed the Police Department had to trust to such local people as they could induce to build a brick kiln for the manufacture of bricks.

3,359. He advocated that all departments should combine and concentrate their work in a particular area so that the Public Works Department might have a number of works close together, and remarked that if the Public Works Department undertook the work he would for the present be prepared to construct police buildings in a particular order rather than departmentally in places where they were most needed. The Education Department for instance should be required to construct a school in a particular area although it might not be the most urgent school required in order that the programme of work in a particular area might be adhered to. It was very difficult to say which police buildings were the most important. No permanent quarters for the police existed at present but temporary buildings had been erected until permanent structures could be constructed. He would not prefer to build permanent quarters for the police at places in which rents were at

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their lowest and the need for accommodation most acute rather than construct them in a particular area because conditions were so general at present that the need for selection would not arise.

3,360. He complained that a large number of projects which had received administrative sanction had been held up pending the allotment of funds, but admitted that the Public Works Department were justified in complaining that the Police Department called for a large number of estimates although there was no possibility of providing funds therefor, thereby throwing a great deal of unnecessary work on them. The Police Department maintained a list of projects from which the Finance Department selected such projects as they could finance, and it was desirable from the point of view of the public benefit that this list should be kept within reasonable limits, but it would be necessary for other departments to do the same as it would be obviously unfair if in so doing the Police Department were given money for three or four projects whereas other departments with longer lists of projects were given allotments for say fifteen. Conditions in the province were abnormal at present but he had no complaint to make on the latter score as the department had received their proportion of grants each year.

3,361. The procedure followed in regard to the budget for public works was that each department drew up a list of projects for consideration by a Finance Committee who suggested the allotments for the purpose of construction. The list embraced only such works as had received administrative sanction, including those that had been so sanctioned and were pending, and was prepared in the first instance by heads of departments. The whole budget was eventually considered in Council.

3,362. He explained that projects were occasionally eliminated in what he had described in his written evidence as the third or fourth stage of administrative sanction in order to make way for those of a more urgent and pressing nature. Hence the complaint made by the Public Works Department that there were an enormous number of plans and estimates requisitioned by Civil Departments which never materialised. Stricter control was now being exercised at stage one, and endeavour was being made to evolve a system under which police Superintendents would not requisition for works indiscriminately. As far as he was aware the Police Department were not in a position to know what money would be allotted in a particular year for the construction of their buildings, but they could form a rough idea of this from the grants allotted in previous years. Urgent demands from other departments had, however, to be considered, and the Finance Committee had to decide the respective degrees of urgency of works.

3,363. (Sir Noel Kershau.) Outpost buildings cost about Rs. 3,000 and lasted on an average for seven years, but a better class of building was now required for the police. In Bihar most of the police buildings were constructed with mud walls; they contained no windows and had no ventilation, and he did not think buildings of such a nature would, under any circumstances, be selected as suitable for the police now-a-days. If a building of a *pucca* character had been constructed for the police 10 years previously, and another of a similar type was needed, the same class of building would be suitable as the Police Department had not altered their plans appreciably in the *interim*.

3,364. The 151 projects referred to in his written statement comprised projects of all departments, the police projects totalling 24, some of which had been

pending since 1914. He did not think the police could, in normal times, expect more than four or five buildings to be constructed yearly, that is to have all their projects constructed in less than 6 years but other projects would be added to the list as time went on. There had been many changes in the Police Department. The force had been increased as also the number of officers and this, of course, necessitated new quarters to the extent of about 35 per cent.

3,365. (Mr. Mackenzie.) Objections might be raised by some departments to the scheme outlined in his written statement for the concentration of work in a particular area and to the postponement of the construction of their buildings to make way for the erection of police buildings, but other departments would benefit by his scheme as well as the Police Department. To the contention that if road schemes had to be postponed on account of the urgency of police buildings in another locality objections would be raised and questions asked in the Legislative Council, he replied that he thought that people would prefer to have a certainty of getting their projects through to the uncertainty which existed at present.

3,366. (Rai Bahadur Ganga Ram.) The buildings constructed by the Police Department previously referred to, which lasted for seven years, were kept in repair by calculating the requirements in this connection at the rate of Rs. 50 for outposts, Rs. 100 for the larger police stations, and Rs. 200 for Reserves, but this did not imply that the respective sums were actually spent on the particular buildings, as each district was allotted a grant for its buildings and it rested with the Superintendent to spend it to the best advantage. There were two or three ways of obviating the difficulty of repairs and the one he most favoured was the construction and repair by the Public Works Department of a cheaper kind of structure. He had not tried the system followed by the Postal Department, namely, inviting *lambarbars* to construct a building on their plans and maintain it for a period of about 20 years, the department paying rent at 6 per cent. for a good building and 10 per cent. for a *kutcha* building. The adoption of such a system would result in the relinquishment of land by the Police Department, but it would perhaps be convenient in the case of the establishment of new posts which, however, would be few.

3,367. (Mr. Cobb.) The Inspector-General decided on the recommendation of the Magistrate and the Deputy Inspector-General of the Range whether a building costing Rs. 2,500 or less should be constructed of first or third-class materials, and the latter was generally decided on because of the difficulty of getting buildings of this value constructed by the Public Works Department and of obtaining the requisite funds. The Inspector-General was not empowered to construct first-class buildings costing more than Rs. 2,500. This limit had formerly been Rs. 1,500.

3,368. The value of the 24 projects he had referred to was Rs. 5,80,000 and the annual allowance for original works had been Rs. 4 lakhs in 1914-15, Rs. 3 lakhs in 1915-16 and Rs. 2 lakhs in 1916-17, but the conditions had been abnormal in 1916-17.

3,369. (Mr. Bremner.) Prior to the year 1912, in which year the new province had been created, the Police Department had not been granted so large an annual grant as Rs. 4 lakhs for the construction of buildings in districts that now formed the province, and it was his opinion that the department had been starved when the present province formed part of Bengal.

J. N. SHAW, ESQ., Partner, MESSRS. CHATTERJEE SHAW AND CO., Contractors, Monghyr.

MR. J. N. SHAW called and examined.

3,370. (President.) The witness stated that he was the representative of Messrs. Chatterji Shaw and Co., a firm of building contractors in Bhagalpur which undertook Public Works Department building contracts. There were no trained engineers on the permanent staff of his firm, but sub-overseers were occasionally engaged temporarily for particular works.

3,371. Contractors were divided into two classes by the Public Works Department in Bihar and Orissa according as to whether they were able to employ experienced engineers on their staff or not. The first class consisted of master contractors and the second class of petty contractors. Certain large firms which had accepted work in the province were classed as

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master contractors, while the others, who were not financially able to employ even permanent overseers on their staff, were classed as petty contractors. Contractors belonging to this latter class were generally assisted by government in the execution of the works they undertook to construct, and he did not disapprove of the system of classification.

3,372. His firm generally accepted government contracts at the Public Works Department sanctioned rates, since they were not paid sufficient to admit of their accepting lump sum contracts. If his firm were paid establishment charges in addition to the sanctioned rates they would be willing to accept lump sum contracts, as they would then be in a position to employ qualified men on their staff. He considered the present practice of giving out contracts on sanctioned rates the best system for the province as contractors were not sufficiently advanced to permit of lump sum contracts being offered to them or of their accepting such contracts.

3,373. When Messrs. Chatterji Shaw and Co. tendered for contracts that were given out on sanctioned rates, their tenders were generally based on those rates and not on a percentage above or below them, because the firm were satisfied that the rates were fair and had been fixed by responsible officers of the Public Works Department who were the best qualified to estimate them. It was possible for his firm to execute work at lower rates but its standard would be inferior. Hence, for the standard of work demanded, they were unable to construct works at rates below the estimated rates of the Department.

3,374. When this firm undertook a contract it was the practice of the Public Works Department, as in the case of other similar contractors, to supply them with such materials as iron, steel, cement, paint, etc., and in most cases also bricks. He did not approve of the supply of such materials by government and desired that the system be altered so as to permit contractors to supply their own materials such as cement, etc. He also disagreed with the contention that, as bricks were not available in the open market, it was necessary for the Public Works Department to arrange for their supply prior to the commencement of a work and remarked that it was quite possible for contractors to manufacture the bricks required for a work provided they were given timely notice. Though brick-making was practically a separate business in Bihar, a contractor occasionally manufactured his own bricks when he had sufficient time. When his firm undertook a contract for a private individual they generally obtained the bricks required from brick-makers. The firm never sub-let portions of government contracts which they accepted, but they employed sub-overseers to supervise the works on their behalf. The staff employed by the firm attended to the brickwork, wood-work, plaster-work, etc., themselves and a Chinaman was never engaged for the wood-work.

3,375. The annual average amount of the contracts accepted from government by the firm was Rs. 1½ lakhs and the largest individual work they had executed was worth Rs. 40,000 or Rs. 50,000. This size of contract was about the largest that the firm was entrusted with. Just previous to the period when tenders were invited for the construction of the buildings connected with the New Capital at Bankipore his firm were expecting several large works in Bhagalpur and Monghyr, and as they were not likely to be more benefitted by taking contracts in Bankipore, they did not tender for any of the works there.

3,376. He suggested that entire projects should be given by government to single contractors in order to encourage private enterprise. It was the practice at present to give out work piece-meal, e.g., wood-work to one contractor, masonry-work to another and iron-work to another and so on, with the result that the several contractors engaged were not in a position to learn each other's work and hence were unable to tender for an entire work. If his suggestion were approved the margin of profit to be allowed for could be reduced since it would

then only be necessary to allow for one contractor's profit thus ensuring the cheaper construction of work.

3,377. (Mr. Cobb.) It was generally the practice of the Public Works Department in Bihar not to invite tenders for entire works. Contractors were therefore not given the option to tender for an entire work, but had to accept a portion.

3,378. The Public Works Department schedule of rates was fair and his firm had found in most cases that they were able to erect buildings at the rates contained in this schedule. In the few cases in which this had not been feasible they had made an analysis of the rates and submitted it to the Executive Engineer who, if satisfied with its correctness, generally allowed higher rates.

3,379. (Rai Bahadur Ganga Ram.) The firm had been established in Monghyr and Bhagalpur for the last eight or nine years. Previous to this they had been established in Champaran and had occasionally come to Bankipore on the formation of the new Province of Bihar and Orissa.

3,380. He himself was a partner in the firm but neither he nor the other partners had received a regular course of training in engineering.

3,381. The firm possessed a brick-manufacturing business of their own at Bhagalpur, and though they sold bricks to private individuals the outturn of the kiln was mainly intended for government works. The first-class 10 inch bricks manufactured by the firm were sold at the rate of Rs. 9, the second-class bricks at Rs. 7 and the third-class bricks at Rs. 6 per thousand. Government purchased bricks at the firm's rates and paid the cost of cartage in addition.

3,382. He did not approve of the suggestion that government should manufacture bricks departmentally and supply them to contractors, and advocated that whenever possible a contractor should be allowed to undertake both the manufacture of bricks and the construction of the building. He did not consider it probable that the contractor in such a case would be tempted to use an inferior class of brick on the building, since the contractor's work was always supervised by the government staff.

3,383. He modified his remark that his firm did not sub-let work to the extent that he admitted that they gave out work on what was termed "job work" i.e., that a particular amount of labour was engaged to execute a particular quantity of masonry-work, etc.

3,384. (Sir Noel Kerchar.) The firm had accepted contracts for portions of a building work, and he agreed that under the system of giving out separate portions of a work to separate contractors difficulty was occasionally experienced from the fact that one contractor might be inconvenienced by the delays of another. For instance a wood-work contractor might complain that his work was delayed owing to the brickwork not having been completed in sufficient time to allow the wood-work to be put in. In such a case the contractor who was inconvenienced ought to be held to have a claim against the Public Works Department if such a claim were well founded. He, however, had not had personal experience of such a case, and was therefore unable to say whether compensation should be paid by government to the contractor on account of the inconvenience caused to the latter.

3,385. (Mr. Bremner.) In suggesting that a contractor should be permitted to manufacture the bricks as well as to carry out the brickwork in a building contract, he expected, in cases where the bricks were ready some time before actual construction work was started, to be paid for the bricks as soon as they were manufactured and not when actual construction was commenced. He did not think for instance that the contractor should be obliged to await payment for bricks manufactured for works which were to be executed in 1918-19 until allotments were made for them.

3,386. Though the brick-making season generally began in October it was possible for a contractor who received a contract to erect a building before September to manufacture the bricks and have them ready for use by the end of the following March. If the order were

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given to the contractor in September, it should be possible for the bricks to be taken out of the kiln by the end of December or at the beginning of January.

3,387. (President.) He approved of the suggestion that government should grant advances for the purchase of materials to certain small contractors of established reputation who did not possess much capital. Contractors at present received payment for materials delivered at site of work, but did not receive advances for the purchase of such materials. Advances would be of great help even to large contracting firms and he con-

sidered that the introduction of such a system would encourage contractors. Contractors at present usually undertook work on borrowed capital for which they generally paid interest at the rate of 9 to 12 per cent., but a well established firm of contractors with a good reputation were usually charged 6 to 9 per cent. interest. Contractors were paid for completed parts of works in progress once or twice a month. His experience had been that the Department was prompt in making payments and he was not aware of any complaints having been made in this connection by contractors.

F. E. S. MORRISON, Esq., Vice-Chairman, District Board, Bhagalpur.

Written Statement.

3,388. My knowledge and information as regards the greater number of points referred to the Committee for inquiry and report by the Government of India is not sufficient to justify an expression of opinion by me on these. I therefore can venture an opinion only as regards the transfer from the Public Works Department in areas within the jurisdiction of local bodies, as on this point I have some little experience and information. It seems to me that there would be a distinct advantage economically and possibly in efficiency too in such a transfer.

3,389. The majority of local bodies have now available under them expert assistance of the same standard of professional training as form a divisional staff in the Public Works Department. A small strengthening of the staff under a local body could readily maintain the work economically and with efficiency. The advantages would be a lower expenditure—

- (i) on establishment,
- (ii) in office charges,
- (iii) in travelling allowances, and
- (iv) probably in rates too, as a more correct schedule of rates for a particular area would be worked.

It would secure a more continuous supervision, particularly in repair and minor original works, which would ensure better work. Incidentally, I think it would also, by placing one local authority in charge of all the works of a particular area, who would also have the placing out of these, help the local "growth of firms of standing in the building and allied trades", one of the objects sought to be served by the Government

of India, regard being had to the fact that excepting in large cities and capital towns, and it may in some exceptional *mofussil* areas, the ordinary individual items of work are small and rather of a petty nature.

3,390. The taking over of the additional charge by local bodies would necessitate the strengthening not only of its engineering staff but also the office staff of both engineer and local body. This increase however would, I consider, result in a considerably lower expenditure than what is being incurred. Some difficulty as regards staff would be experienced by local bodies when, in response to the requirements of a particular department, a large original work had to be undertaken with the existing staff. Such demand on the staffs permanently under local bodies would be few and could be met by taking on temporary hands. This I believe is the system by which even the Public Works Department at present meets extraordinary calls on its staff resources, though no doubt the permanent staff of a divisional charge in the Public Works Department is more flexible than will be the case with the ordinary permanent staff of, say, a district board.

3,391. In case of transfer, I think the system of accounts maintained under a local body should be as far as possible uniform. And again, if possible, the system at present prevailing under local bodies, with modification if necessary, which will be better understood by them and their staffs, should be continued as regards the works made over, in preference to that employed by the Public Works Department. This would entail, I think, first a smaller increase to staffs under local bodies, and second save mistakes and complications.

Mr. F. E. S. MORRISON, called and examined.

3,392. (President.) The witness stated that he had been the vice-chairman of the Bhagalpur District Board but that he had resigned that office in December 1916. The board consisted of 31 members, including the chairman, and the Collector was *ex-officio* member and chairman. The other official members included sub-divisional officers, the Superintendent of Police, the Doctor and the Deputy Inspector of Schools; but the Executive Engineer was not a nominated member. There were 5 European members and the remainder were Indians. Out of the latter about 4 were officials.

3,393. The budget contained a list of the works to be carried out in the succeeding year. It was prepared and passed by the finance committee prior to its acceptance by the board. The members generally did not discuss the details, but only the particular items in which they were interested. They evinced a fair amount of interest in the works in which they were concerned and generally succeeded in having them included in the budget. The members of one sub-division were not, however, interested in the works in another sub-division. When the list of works was finally sanctioned by the board and individual allotments were made, plans and estimates were prepared and submitted for sanction to the board, through the finance committee. Members took an interest in the plans which related to works in which they were concerned, but owing to their being non-experts they were content to see that a work was included in the budget and to leave its execution to the district engineer. The district engineer recom-

mended to the board, through the finance committee, the name of the contractor whose tender should be accepted. Occasionally the members of the board displayed an interest as to who should be given the contract, but they ordinarily accepted the recommendations of the district engineer. There was not much canvassing in this connection, and steps had been taken to discourage it. Canvassing was not a constant evil and occurred only occasionally. The decision as to whether a contract should be given to one or more contractors rested with the district engineer, on whom the board depended to a large extent in the settlement of the details connected with the execution of work.

3,394. It was the practice in some cases in which a member was keen on a particular work to hand over its execution to such member instead of to a contractor, an allotment being made to the member to cover the cost of the work, and to hold him responsible for its proper execution. The member in such cases was primarily accountable to the district engineer for the proper execution of the work and finally to the board, to whom all accounts connected with the work were submitted. The witness had had no occasion to find that the system had led to any abuse during the 11 years he had held office as vice-chairman, as allotments were not made indiscriminately but only to such members as could be trusted.

3,395. As vice-chairman he had had no occasion to see the inspection notes written by the Superintending

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Engineer in his capacity as Inspector of Works. He could not, therefore, say whether the Superintending Engineer performed any useful functions as Inspector of Works. The rule which required that estimates in excess of a certain sum should be submitted to the Superintending Engineer for approval afforded a useful check and the Superintending Engineer's scrutiny of the plans and estimates was of great value as the members of the board did not possess expert knowledge and had to rely solely on the district engineer.

3,306. The district engineer was appointed by the board provided he possessed the qualifications laid down by government. Only one appointment had been made since the witness had been a member of the board as the previous district engineer had occupied the post for about 30 years. On that occasion the applications were placed before a meeting of the board and were scrutinised by the chairman together with the testimonials of the applicants. No canvassing for the appointment had taken place and the selection made by the chairman was accepted by the board. The witness was not quite sure whether the appointment was subject to the approval of government, but presumed that it was subject to the approval of the Commissioner. He was also not aware whether government had the power to order a district board to dismiss a district engineer as he was not cognisant of any such case having occurred. The Commissioner had probably the power to veto a resolution passed by a district board, e.g., if a district board had passed a resolution concerning the construction of a road which the government did not approve, the Commissioner could probably veto it, but no concrete case of this kind had arisen within his knowledge.

3,307. A government auditor audited the accounts of the board once a year in detail. The board had, as far as he remembered, on two occasions made payments in contravention of the rules and when this was pointed out by the auditor the employees to whom the payments had been made were called upon to make a refund. He had seen remarks in the annual reports in which the expenditure of a board had been criticised as improper by the auditor, but such irregularities had not occurred in the Bhagalpur District Board, and he knew of no instances where particular expenditure had been objected to as improper by an auditor. He did not think that government had any power to enforce the individual responsibility of the members in the case of improper expenditure nor did he think it would be practicable. In his opinion the criminal law should be made applicable in such cases. The Indian Audit Department could not, like the Audit Department in England, call upon members to make good improper expenditure, and he did not think it would be desirable to vest government with such power as it would deter individuals from accepting seats on the board.

3,308. The district board was in charge of practically all the roads in the district except the main trunk road. No regular grant was made by government for the maintenance of the roads, and they were maintained by means of the road cess and occasional grants made by government, e.g., the Commissioner had recently made a grant for metalling a particular road in the Bhagalpur district. Special grants made by government for special purposes were utilized on the objects for which the grants were given and were not diverted to any other purposes. An account showing how the grants made by government had been spent was maintained by the district engineer and excess expenditure was met by the board. The roads were maintained by the district boards as satisfactorily as funds permitted, but it was desirable that a larger sum of money should be spent on them. The board got good value for their money.

3,309. Except for the district board office building, which was a double-storied building, all the other buildings constructed by the district board, e.g., primary schools, inspection bungalows and dispensaries, were fairly small. The largest building, other than the board's office, which the district board had constructed was an inspection bungalow at sub-divisional headquarters and this cost about Rs. 13,000. He did not agree that the work

done by district boards was substantially inferior to that done by the Public Works Department as he considered the buildings which had been constructed by the district board were nearly as good as the ordinary Public Works Department buildings except that the latter had probably a better finish. The class of work done in dispensaries, schools, etc., had formerly been poor, but the present policy was to replace all these buildings by pucca buildings, which latter were of about the same standard as the Public Works Department buildings. He could not state definitely whether Public Works Department buildings were more or less expensive than those constructed by the district boards as he was not aware of the cost of Public Works Department buildings.

3,400. The witness had had no experience of the construction of government buildings by district boards, but mentioned that the district board of Bhagalpur had at one time been in charge of all the buildings in the district. This system had worked satisfactorily for about seven years, at the end of which government reduced the grant they formerly made to the board. The arrangement thus came to an end as the district board was unable to execute the government works on the reduced grant. It was not discontinued on the recommendation of a committee which had been appointed to consider certain questions concerning the working of local boards, as he had seen a resolution of the board in which it was stated that they could not accept the terms offered by government as they did not think that the grant it was proposed to make was sufficient to meet the cost of the works. When a district board constructed a building for government at present it was, under rule, given a grant of 15 per cent. on the estimated cost of the building.

3,401. During the years in which the board had erected buildings for government, maintenance and repair works had been carried out by a portion of the Executive Engineer's staff subject to the supervision of the district board engineer. The former staff were paid by government who made a monthly allowance of Rs. 50 to the district engineer for the additional work in this connection. For original works, the district boards had been given 15 per cent. on the allotment plus 5 per cent. extra for contingencies, and it had been the practice to offer each individual work to the board. From inquiries he had made of the then district engineer he had ascertained that one of the chairmen had given him something out of the 15 per cent. allowed to the district board by government, and that the other chairman had not given him anything but had credited the entire amount to the board. He personally was of opinion that no portion of the grants by government should be given to the district engineer.

3,402. He advocated that all government roads and buildings in the districts might be transferred to district boards as he considered it would lead to a great deal of economy inasmuch as it would obviate the existing duplication of staff, and added that an officer of the Public Works Department had sometimes to go a long distance over a district board road to do a small work whereas the board had its own man in each sub-division who could very well attend to such work. The present staff of the district board was competent to deal with all government works, including original works, provided it was augmented. In the event of such a transfer it would, however, be necessary for government to exercise some form of control over the expenditure and the standard of the work, and for this purpose it would be necessary to appoint a competent engineer as Inspector of Works. If the Inspector of Works found on his inspection that the works had not been properly maintained and that money had not been profitably utilized he could report the matter to the board, which could call upon the district engineer for an explanation. It was not desirable that government should have the power to fine district boards in cases of faulty execution of work and to insist on their doing the work properly at their own expense, but government might retain the option of calling upon the board concerned to fine its district engineer, whose responsibility for work should be the same as that of an Executive

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Engineer. There was no objection to government possessing the power to require district boards to dismiss or punish a district engineer who was responsible for bad work, but it was not possible to make the district fund responsible for any money that might have been squandered, as such action would have a paralysing effect on the other works of the board. It would likewise not be right to hold the board responsible for the misdoings of the district engineer, as the Commissioner had the power of vetoing the latter's appointment.

3,403. He was not in favour of a combined cadre for the district engineers in the province which would permit of the transfer and promotion of district engineers from one district to another and did not think the scheme was practicable. He anticipated that the boards would resent the proposal as it would interfere with their powers of appointment and render them liable to lose the services of such of their engineers as were good. He cited an instance in which his own board had selected an outsider in preference to the engineers in the province because of the former's superior qualifications.

3,404. (*Sir Noel Kershaw.*) If the candidate selected in the above case had not applied for the post the board would not necessarily have selected a district engineer but would have made the selection on the strength of the certificates and qualifications of the applicants. If a really good man in an adjoining district had, however, applied for the post, the board would no doubt have been willing to offer him the appointment. In this way a man serving in a second-class district might in due course have a chance of being promoted to a first-class district. A district board engineer would have the advantage over an outsider by virtue of his having had practical experience of district board work.

3,405. The predecessor of the present district engineer had held his appointment for about 30 years and had not got stale in his work: he was given about eleven extensions of service and retired at the age of about 70. The present engineer had held his appointment for about six years, and the question whether a man got stale or not in his work largely depended on his personality. Service as a district engineer was permanent as in government service but it was non-pensionable. District engineers, however, could contribute to a provident fund.

3,406. The district engineer would have to be paid something extra for the work that would be imposed on him if all government works were transferred to district boards, and there was no objection to government reserving the right to withhold a portion of the allowance in the event of improper work. The same principle could not, however, be applied to the grant made to the district board for supervision as it would result in the depletion of the resources of the board. The board did not execute work themselves but had to depend on the district engineer for its proper execution. Hence any safeguard it was proposed to have should have reference to the man who actually carried out the work and not the board, but as the work of the board was controlled by the Commissioner there was really no danger of anything going wrong. He admitted, however, that there should be some provision to meet the case of a particularly bad district board which distinctly failed in its duty and did not look after its working properly, but did not agree that the individual members should be made responsible in such a case. If the board was absolutely perverse and did not pay any attention to defects which were brought to its notice the only real remedy was to dissolve the board, in which case government would have to take over all the government and the board's works as well.

3,407. He had not discussed the scheme regarding the transfer of government work to district boards with any members of the boards and could not say how they would view it.

3,408. (*Mr. Mackenzie.*) There were two classes of district engineers. The maximum pay of a district engineer of the second-class was Rs. 600 a month, and a man of this class would be competent to deal with the government work which he had proposed should be

transferred to district boards. The class of government district work was not much superior to that at present executed by the boards. For instance, in Bhagalpur which was a first-class district, the ordinary *kutcherry* building and the post office were very much the same and were representative of the class of buildings ordinarily constructed in the districts. The largest building in a district under the board usually cost between Rs. 10,000 to Rs. 13,000 or perhaps less, and a larger staff would have to be employed for the construction of the larger buildings. The district board was capable of doing bridge work. It had a project in hand costing over Rs. 50,000 and another scheme costing about one lakh of rupees which had been held over for want of funds.

3,409. (*Rai Bahadur Ganga Ram.*) Estimates in excess of Rs. 10,000 and Rs. 2,500 were submitted for approval to the Superintending Engineer by first and second-class district engineers respectively.

3,410. The maximum pay of the Bhagalpur district engineer who had retired after putting in about 30 years' service was Rs. 1,000 a month, inclusive of a personal allowance of Rs. 200 a month, and he had not been given any reward by the district board at the time of his retirement but was in receipt of a pension from government and the district board. Ordinarily, the maximum pay of a district engineer in a first-class district was Rs. 1,000 a month.

3,411. The witness stated that he was an indigo planter and *zemindar*, and that he had first been nominated a member and then elected as vice-chairman of the board. A little less than a half of the members ordinarily resided at headquarters, and they were mostly *zemindars*. One or two of them were pleaders. Very few of them took a real interest in the work of the board, but they evinced an interest in the roads in which they were personally concerned. The members themselves would not care to take charge of buildings, as they lacked professional knowledge.

3,412. He was not aware of the recommendations of the Bengal committee which condemned the local board system and did not know whether their recommendations had reference to the Bhagalpur District Board.

3,413. (*Mr. Cobb.*) The number of elected members in a district board depended on the number of members elected by the local boards. The actual election of members took place in the local boards who appointed 12 to 14 members. In addition to these there were the members nominated by government. The district engineer was not an official member as he was a servant of the board. Certain government officers, however, were members of the board, so that there was a distinction between a servant of the board and a servant of the government. The latter were mostly nominated members with the exception of the Collector who was an *ex-officio* member. There were three methods under which government officers were represented on the board, as *ex-officio* members, as nominated members and as advisory officers, e.g., the Civil Surgeon controlled the medical department of the board. This system helped to bring the Civil Surgeon in touch with the other members of the board and instead of being an inconvenient arrangement was an advantageous one.

3,414. The board had a subordinate staff of supervisors, overseers and sub-overseers and a clerical establishment. This staff was appointed on the recommendations of the head of the department which were as a rule accepted by the board, but there had been occasional instances where canvassing had taken place.

3,415. Besides the finance committee of the board there were the educational, medical and sanitation sub-committees. These committees prepared their own budgets and submitted them to the finance committee. The board spent more money on public works than on education as they were bound under law to spend the whole of the road cess on public works.

3,416. The occasional execution of works by members was really a matter of convenience. The district engineer was responsible for the execution of all public works, but sometimes he found it very difficult to induce con-

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tractors to work in a particular area. He therefore entrusted the execution of work in such cases to a member of the board who was fairly above suspicion and had local influence.

3,417. (President.) He considered that the scheme he had proposed for the transfer of government works to district boards would be workable, even if a non-official chairman was elected by the board instead of the Collector who could at present look to the interests of government, as the Commissioner would still be the controlling authority. The success of the scheme, however, would depend on the personality of the chairman who was elected.

3,418. (Mr. Bremner.) The witness had been vice-chairman of the Bhagalpur District Board for 11 years up to December 1916, but could not say definitely whether during that period a Superintending Engineer of the Public Works Department had been the Inspector of Works or whether the Inspector of Works had been a whole-time officer. (Mr. Bremner here explained that up to the year 1912 the Bhagalpur Division had had

a special whole-time Inspector of Works who was not in charge of a Public Works Department circle and whose sole duty was to inspect district board works, and that this explained the fact that the witness had not seen any inspection notes.) The witness thereupon stated that he had not meant to say that the Inspector of Works had not written any inspection notes, but merely that he had not seen them. Many of the papers treated as routine had not been submitted to the witness but to the chairman, but if there had been anything exceptional in the inspection notes and grave criticism as to bad work, etc., such a paper would have been submitted to the board and seen by him.

3,419. The dismissal of a district engineer would probably require the approval of the Commissioner, but he was not aware of the rules on the subject. He admitted that the board would have to make out a very strong case against a district engineer in order to get rid of him and that they would have to satisfy the controlling authority that they had a really good case.

F. MAYNARD, Esq., M.L.C.E., M.R.S.L., District Engineer, Gaya.

Written Statement.

3,420. (I.) Economy and suitability of methods of execution of public works.—They are suitable in *mofussil* stations, but it must be recognized that in the present condition of things European supervision is essential, and with an improved status and increase of powers of district engineers and staff, work could be undertaken by them, at present done by the Public Works Department, which would I think lead to economy.

3,421. (II.) Encouragement of other agency.—So long as it is recognized that "private firms" of reliable standing are unable to take up work in the *mofussil* economically, private enterprise is sufficiently encouraged inasmuch as tenders are called for for all works of importance. With the class of agency available in the *mofussil* it is certainly not desirable or possible to entrust to it the construction and upkeep of any public works without efficient departmental supervision.

(2). As far as I am aware, I cannot uphold the recommendations of the Committee with regard to getting public work done by private contractors without departmental

supervision; but if civil works are discharged through the agency of the district boards and municipalities as recommended by the Committee, the staff of the Public Works Department below the rank of the Superintending Engineers would be, I think, reduced greatly if not altogether done away with.

3,422. (IV.) Relations with other departments and sub-branches.—These are, as far as I know, satisfactory.

3,423. (VII.) Education.—The theoretical training, as far as it goes, is broad enough, but no private agency will employ a boy straight from college; a longer and more practical training is desirable. The candidates attracted to the colleges are generally suitable but no boy straight from college is of much use without 2 or 3 years' practical training, either articulated under some reliable English engineering firm, or under government.

3,424. (VIII.) Practical training.—I do not think adequate provision is made at present; the practical training ought to be longer and more varied and "specializing" ought to be encouraged. The present stipend awarded to students under practical training does not appear to me to be sufficient.

Mr. F. MAYNARD called and examined.

3,425. (President.) The witness stated that he was the district engineer of Gaya and that he was in his 20th year of service. He added that Gaya was a first-class district board and that it paid its engineer Rs. 800—10—1,000.

3,426. He advocated that the status of district engineers should be improved, that their pay should not be less than that of the Public Works Department, imperial service, and that district engineers should be vested with increased powers. He explained in the latter connection that a district engineer could not sanction an estimate of Rs. 200 whereas a Public Works Department Executive Engineer could accord sanction up to that amount himself and start the work and accept agreements up to Rs. 5,000; and added that the district boards had not delegated powers to their district engineers although this was very desirable. In his opinion, first-class district engineers should possess exactly the same powers of sanction as Public Works Department Executive Engineers in the matter of the acceptance of tenders and agreements. It was true that there was a considerable difference between the two classes of officers, but the nature of the works executed by district boards was practically identical, if not more important. He had not placed his suggestion before the district board and could not say how they would view it, but he considered the finance committee hampered its engineer in the execution of his duties and interfered unnecessarily in the selection of tenders. The district board seldom, if ever, disagreed with the district engineer. He could not agree wholly with the statement of one witness that the district engineer placed

his proposals before the finance committee of the board with a recommendation as to the particular tender which should be accepted and that such recommendation was accepted as a matter of course, as the finance committee sometimes objected and interfered in the selection of the tender and could not furnish valid reasons for doing so. Such interference, as far as he was aware, was merely due to a difference of opinion as to the best course which should be adopted.

3,427. Tenders were invited whenever a work was to be given out on contract, and it was not the practice to give out lump sum contracts. Work was generally given out on piece-work and full details of the estimate and quantities were supplied when inviting tenders. Contracts were not split up, but were usually given to one contractor on the schedule of rates. The tenders received were generally at a percentage below the sanctioned rates, but the lowest tender was not as a rule accepted as it was usually submitted by an unqualified contractor. A register of contractors was maintained in his office which contained a record of the work of contractors.

3,428. Contracts for buildings had reference both to construction and the supply of materials, and were given to one contractor; hence the Public Works Department practice of giving out separate contracts for the separate classes of work in a building and the manufacture of bricks was not followed. Contractors were allowed to supply their own cement if small quantities were required, but in the case of large supplies the district board purchased its own cement and had it tested

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in Calcutta prior to its use on works, as local contractors could not be trusted to use good cement. In his opinion, the latter precaution was a sufficient safeguard against the use of inferior cement on works of magnitude.

3,420. The Superintending Engineer in his exercise of the functions of Inspector of Works checked estimates in excess of Rs. 10,000. The check on estimates of about Rs. 10,000 was not of much value, but in the case of larger estimates it was of great assistance to the district engineer. In his opinion the limit was too low and should be raised to Rs. 50,000. In support of this recommendation he stated that the district board had at times carried out works worth Rs. 5 lakhs and more, and that it had at present under consideration an estimate for a bridge costing over Rs. 4 lakhs, another project costing about Rs. 1½ lakhs and a school building estimated to cost about Rs. 80,000. The last named was a private school building which had been made over to the district engineer. He admitted, however, that the majority of district buildings were usually small.

3,430. The witness had had no experience of works constructed by district boards for government except some small school buildings, but he was doubtful whether the board were paid 15 per cent. for supervision in the case of such buildings. In the case of headworks, weirs and buildings other than schools the board were paid 15 per cent., 5 per cent. of which was made over to the district engineer—2½ per cent. for the preparation of plans and estimates, and 2½ per cent. for supervision. This system had worked satisfactorily and he had not heard any complaints made by the members of the board that their own works had been neglected in the interests of government works. Under rule a Superintending Engineer could order the cessation of works, other than district board works, if he considered the latter were not being properly attended to.

3,431. The Superintending Engineer as Inspector of Works regularly inspected works in progress in the Gaya district and forwarded inspection notes which were of great value and help to the district board.

3,432. He did not agree with the view expressed by some witnesses that the quality of work executed by district boards was generally very much lower than that of the Public Works Department and that the materials utilized by the former were also inferior. He considered that the materials utilized were ordinarily as good as those used by the Public Works Department and that the latter utilized no better materials than district boards, e.g., when the district board built a school they used as good bricks as the Public Works Department did in the construction of a police station. The district board schedule of rates differed in some cases from the Public Works Department schedule, e.g., in the case of the jail and the large post office building at Gaya the Public Works Department rates for masonry were about Rs. 26 to Rs. 27 as compared with Rs. 21 the district board rate; while for concrete they were Rs. 21 and Rs. 16 respectively. He could not, however, quote any other instances in which the Public Works Department rates were higher than the board's rates as he had not gone into the question and generally did not evince much interest in the work carried out by the Public Works Department. In the circumstances he was unable to offer a professional opinion on the respective cost of work executed by the Public Works Department and the district boards, but he was inclined to the view that the Public Works Department rates were ordinarily 10 per cent. greater than the rates of the district boards.

3,433. He advocated that district boards should take over all the government buildings and roads in the *mofussil* stations in addition to large original works, and considered they would be competent to undertake the erection of a court house which cost a lakh of rupees or more as well as the construction of a new large road. He added, with regard to the latter, that the board employed a staff of surveyors who were competent to survey new roads, and that they already did such work and prepared their own plans for bridges, etc.

3,434. He recommended, in the event of the acceptance of his proposal, that somebody of the status of a Superintending Engineer should control the government works as an Inspector of Works. The principal functions of the Inspector should be to ascertain the qualifications of men entrusted with the execution of works and to dispense with the services of inefficient subject to the approval of the board. It was true that the exercise of this power would lead to friction between the Inspector of Works and district engineer, but the former as a matter of fact at present reported bad work of a district engineer to the district board and requested an explanation. If the explanation furnished was unsatisfactory the board could dispense with the services of the district engineer subject to the approval of the local Government. He did not mean to imply that the Superintending Engineer should exercise the power he had suggested independently, but that he should proceed through the district board.

3,435. He approved of the suggestion that a combined cadre of district engineers should be formed for the whole province, as this would admit of the transfer of district engineers from one district to another and thus provide a new field of work and environments, with perhaps new engineering problems, for such as needed a change. He also approved of the interchange of district engineers and their promotion from one district to another, as it would be an incentive to a man in a second-class district to qualify for appointment to a first-class district. Asked as to whether district boards would welcome such a proposal, how a district board which had a good man would feel if it were told that it was proposed to transfer him to another district, and whether the boards would accept this amount of interference on the part of government, he stated that the appointment of district engineers already rested with government. He admitted, however, that their selection was made by the district board and that their appointment was only approved by the local Government.

3,436. His scheme for the construction of public works in a district was to have one agency for the execution of public works in each district, and to place district board as well as government work of all kinds in charge of the district engineer whose work would be supervised by an Inspector of Works. The latter officer would be of assistance particularly to the smaller district boards; the work of a first-class district engineer would not require much supervision. It was only right, if government were prepared to entrust their buildings and roads to the district boards and give grants for the purpose, that they should possess some form of control to satisfy themselves that money was being properly spent.

3,437. If the powers and pay of the district engineers were increased and a better type of men recruited for the appointments it would be an incentive to an engineer in a second-class district to seek for appointment to a first-class district. In his opinion, an engineer appointed to a first-class district should be an officer of at least 8 years' service, and an engineer in a second-class district, an Assistant Engineer with 5 years' experience.

3,438. (Sir Noel Kershaw.) Estimates in excess of Rs. 50,000 should be submitted to the Superintending Engineer, even if the district board engineer was of a higher status with better qualifications and better pay.

3,439. (Rai Bahadur Ganga Ram.) The witness stated that he was in his 20th year of service and that he joined the district board on a salary of Rs. 550. Previous to his joining the district board he had worked as a temporary engineer in the Public Works Department for two years and with a contractor for a period of four years. He had received no training in sanitary engineering.

3,440. He could not, at present, commence a work which cost Rs. 200 without the previous sanction of the board, and it was because of this that he had advocated an increase in the powers of district engineers.

3,441. In connection with his remark that the district board rates for concrete and masonry were Rs. 16 and Rs. 21 as compared with the Public Works Department rates of Rs. 21 and Rs. 26, he was unable to say whether

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the saving of nearly 25 per cent. was due to savings in the cost of material or on account of labour.

3,442. If government transferred their works to district boards they should pay a certain percentage to the district boards for utilization on and strengthening of their staffs, and his recommendation for the transfer of government works to district boards was subject to this understanding. He did not think the boards would be prepared to take over government works if they were not paid a percentage.

3,443. (Mr. Bremner.) He could not say that the mortar used in the masonry work for which he had quoted the rate of Rs. 21 was of the same specification as the Public Works Department as he had only compared the rates.

3,444. District boards would, in addition to original works, be prepared to take over the repair of all government buildings and roads on the same terms as original works, even though there might be no original work in some years and only repair work. The percentage of the cost of establishment to works in the Gaya District Board came to 9, and the income of the board was about Rs. 7 lakhs a year. Of this, about Rs. 1,93,000 was spent on original works, Rs. 1,44,000 on repairs and Rs. 2,58,000 on miscellaneous items of expenditure. During the last three years the expenditure on public works had been Rs. 4,30,000 but this provision had been altered and a portion had been devoted to education, medical and police and the budget for public works had been fixed at Rs. 3½ lakhs, out of which the average cost for establishment was about Rs. 56,000.

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3,445. Entire contracts were given to one contractor and payments were made for materials on approval on delivery. Payments for bricks were sometimes made at kiln site, but they were generally not paid for until they were delivered at the site of the work. Since the war, steel had been purchased by the board, but when it was supplied by contractors they were paid for it as the work progressed. Payments were not made on the completion of each class of work and agreements were not entered into for the supply of material only, but for the work as a whole.

3,446. When the construction of a building was to be undertaken and money had been provided in the following year's budget, it was not usual to commence the manufacture of bricks prior to the receipt of an actual allotment though this had been the practice formerly. It was permissible, however, to arrange for the burning of bricks a year in advance and for the payment therefor before a work was actually commenced. Even if there was not sufficient money to cover the cost of the whole work the contractor was permitted to burn his bricks in the previous year, but such a practice was dangerous as it made things rather awkward if no funds were available in the following year. It had on this account been stopped and no work could now be commenced without sanction and the receipt of a budget allotment.

3,447. A portion of the Gaya district was irrigated, and he presumed the district board would be prepared to take over all the buildings in the district, including those in irrigated areas.

At Bankipore, Monday, 26th March 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member :—

W. S. BREMNER, Esq., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary).

The HON'BLE MR. C. E. A. W. OLDHAM, I.C.S., Commissioner of Patna.

Written Statement.

3,448. (I.) Economy and suitability of methods of execution of public works.—I am of opinion that the present methods are not economical, and not always suitable for the purpose for which they were devised.

3,449. (II.) Encouragement of other agency.—Private enterprise is not sufficiently encouraged at present. Construction and up-keep of certain classes of public works might be delegated more largely to district boards and to private agency, subject to supervision and control by government officers. Construction, particularly, might more generally be entrusted to private agency.

3,450. (III.) Changes in organization.—The organization of the Public Works Department should be modified so as to limit its functions largely to those of an expert supervising and advisory agency.

3,451. (IV.) Relations with other departments and sub-branches.—I do not think that the Public Works Department always meets the needs of other departments. Other departments sometimes feel it would be more expeditious and convenient as well as cheaper to have work executed by other agency. I am not in a position to give any opinion on the relations between the various sub-divisions of the Department *inter se*.

3,452. (V.) Decentralization.—I think there is too much centralization at present, but I do not consider that decentralization would of itself remove the chief objections to the present system.

3,453. (VI.) Simplification of procedure.—I am of opinion that the Public Works Department Code is unduly restrictive. I regret that I have not the time to go through it and point out all the matters in which modification is desirable. The general complaint against it is that it is too rigid, that it does not sufficiently allow for differences in local conditions, and that it does not allow enough discretion to provincial governments and administrations.

3,454. (VII.) Education, and (VIII.) Practical training.—The chief defect in the system of education in government engineering colleges probably is that it is too largely theoretical, and not sufficiently practical. The question is a difficult one. Theoretical training is essential, and how practical training can best be imparted is a question on which the advice of practical engineers will be of most value.

3,455. (General.) Conditions have changed enormously in this country since the Public Works Department was first established, but the methods of the Department have not undergone a corresponding change. There is too great a tendency to stereotype a system that may

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have been necessary when the Department was founded, to strive at constructing every building erected by the departmental agency as if it is intended to last for ever, without regard to the use to which it will be put and the changes in conditions and requirements that cannot be foreseen at the time. The longer experience I have, the more I observe that views as to the propriety of particular types of buildings, and details of construction are inconstant. What was considered to be the most suitable kind of building for a particular purpose fifty years ago is condemned today, and what is regarded as the model of today will be treated as out-of-date and unsuitable fifty years hence.

(2). I am of opinion that the time has come when the functions of the Public Works Department might well be limited in great measure to expert advice, supervision and control. In most parts of India now there are well established and reliable private firms that might be more widely employed than at present. Large firms who carry out building operations on a considerable scale have many advantages over the local officers of the Public Works Department and district engineers. I am in favour of giving out the contracts for actual building work to such firms, the work to be subject to the supervision of officers of the Public Works Department, not below the standing of an Executive Engineer, who

would see that the work was carried out according to the plans and specifications. There is a general complaint abroad that Public Works Department rates are unnecessarily high, and I have been led to understand from what I have been told by members of firms of the highest repute in this country that if control or interference by low-paid subordinates were wholly withdrawn, work could be executed by such firms at lower rates than those which government have to pay under present conditions, that, in fact, there would be a considerable saving to government, and the work could be done just as well. Our aim should, I think, be to work towards a system by which the actual work of building and construction would be done by private firms subject to the supervision and control of officers belonging to the superior staff of the Public Works Department, whose duties would be almost wholly of supervision. These officers might thus be relieved of a great mass of petty detail and routine and office work, and enabled to devote the greater portion of their time to inspection and supervision at different stages of the actual work going on in the various parts of their jurisdiction. The subordinate establishment now entertained might be largely reduced. In my opinion such a system would lead to greater efficiency and greater economy.

The HON'BLE MR. C. E. A. W. OLDHAM, called and examined.

3,456. (President.) The witness stated that he was the Commissioner of the Patna Division, and that he controlled the local bodies in that division in his capacity as such. He had had experience of the inner working of district boards in that he had been the chairman of several such boards when he was in the Collector's grade of his service.

3,457. With the exception of important water-works and drainage projects, municipalities in Bihar and Orissa made their own arrangements for the construction of the whole of their public works and managed such works with their own staff independent of any control on the part of government.

3,458. The Collector of each district in his division was *ex-officio* chairman of the district board and the post of vice-chairman was now held by a non-official. The vice-chairman was elected by the several members of the board, and there were on each board a certain number of members who had been nominated by government, in addition to the elected members, under section 7 of the Local Self-Government Act which read as follows :—"A district board shall consist of such number of members not being less than nine as the Lieutenant-Governor in Council may by notification fix in this behalf and may include elected and appointed members." It was possible for him to furnish only the general proportion that nominated and elected members bore to each other, and to assume that this ratio was as 1 : 2 would be roughly correct, since in the districts of his division there were about 21 members on each board of whom about one-third had been nominated. Nominated members were not necessarily, but largely, government servants. The Executive Engineer was not usually a nominated member of the district boards in the Patna Division.

3,459. District boards in Bihar and Orissa constructed and maintained all the roads in their respective districts with the exception of the Grand Trunk Road that passed through the districts of Gaya and Shahabad, and the Patna-Dinapore Road in the Patna district, the special importance of which had led to their being retained under the direct charge of the Public Works Department, and except in cases where a board undertook to construct a building on behalf of government, these bodies were not concerned at all with government works. It was fairly correct to assume that whenever a board constructed a building for government the latter paid the former as remuneration 15 per cent. on the estimated cost of the building, and that the board were at liberty to pay their district engineer up to 5 per cent. of this percentage. The 15 per cent. was paid for all the details connected

with a work, i.e., the preparation of plans and estimates, working drawings, tools and plant, construction, etc. He did not agree with the contention that the rule under which this percentage was paid by government had acted disadvantageously in that it induced district engineers to neglect the work of their boards in favour of government work, since he had not observed any indication of such an effect throughout his experience. Nor did he agree that this practice was unsatisfactory from the point of view of government in that it tended to induce district boards to increase estimates in order to secure increased percentage charges, as he thought that government had full opportunity of ascertaining such a tendency on the part of the boards through their own agency, i.e., through the Inspector of local works. It was the duty of the Inspector of local works to scrutinise estimates and see that they were reasonable, and he had never had any complaints made to him in this connection.

3,460. The district engineer was a whole-time servant of the district board and the execution of work on behalf of government amounted in the case of this officer to additional work. Consequently, it was only fair that such an officer should receive part of the remuneration paid by government. District engineers were usually appointed on the understanding that they were required to perform only such work as properly pertained to their respective boards. Hence, unless such an officer had accepted an appointment on the understanding that government work was included in the scope of his duties, he did not agree with the contention that, since it was the district board with whom the contract was made by government, the whole of the extra remuneration should be paid to the board and that no portion of it should be paid to the district engineer. He added that there were several district boards which had employed engineers prior to the introduction of the system of payments to district boards for work executed on behalf of government and that it would have been equitable for the boards to appropriate the entire percentages only if it had been laid down in the original agreements of these officers that they should accept the extra government work as part of their duties, whenever their respective boards undertook it on behalf of government. On the whole, therefore, he did not recommend any change in the present rule, as certain government works that were executed by district boards involved considerable extra work on the part of the district engineer and that officer's staff.

3,461. There were two separate agencies for the execution of public works in districts, with the result that

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there was overlapping in several instances. One of these was the Public Works Department, which was in charge of government buildings, and the other the district board engineering staff, which was in charge of the buildings and roads pertaining to district boards. But the suggestion put forward in order to overcome this defect, viz., that the whole of the construction and maintenance of government buildings in districts should be transferred to the staff of district boards, would be feasible only in certain parts of the province which possessed competent and fully qualified district engineers. The several district engineerships in the province varied in grade and pay. There were six grades of such officers. Those in the sixth grade received a salary on first appointment of Rs. 250 and rose by annual increments of Rs. 10 to Rs. 300, and those in the first grade started on Rs. 800 and rose by annual increments of Rs. 40 up to Rs. 1,000. All the three district engineers in his division belonged to the first grade and were consequently fully qualified and competent to undertake the government work in question, but as he was not sure of the capacity of all district engineers in backward districts to undertake government work, he suggested that professional opinion might be obtained as to the competency of each such individual. He agreed, however, that on the transfer of government work to district boards even certain backward boards might be in a position to employ a better class of staff.

3,402. Provided government retained in their hands sufficient safeguards to ensure adequate control on their part over the staff employed by district boards, for instance, by insisting on district engineers of specified qualifications being engaged and subjecting the work of the boards to careful and constant supervision by government agency, he considered a district board to be a satisfactory and competent agency for the construction and maintenance of government buildings. The general qualifications of district engineers were prescribed by government, and though the actual selection of an incumbent rested with the district board, their choice was subject to the approval of the Commissioner of the division concerned. The dismissal of the district engineer was also subject to the approval of the Commissioner, and this provision had been made in order to protect the interests of district engineers. Sufficient provision had been made in the Local Self Government Act with a view to protect the interests of government. For instance, if an Inspector of local works reported unfavourably on a particular district engineer to the Commissioner, the Commissioner could, under the Act, call upon the district board concerned to consider the question of their engineer's dismissal; and if the board declined to enforce dismissal, on reference of the matter to government by the Commissioner, government had power to suspend the board's activities altogether. He admitted, however, that government had no direct power to issue an order to a district board to dismiss their district engineer.

3,403. Government had power to disallow a specific resolution passed by a district board if they considered such a resolution to be prejudicial to the interests of government, in that under Section 121 both the District Magistrate and the Commissioner might "by order in writing suspend the execution of any order or resolution or doing of any act by a district board if in the opinion of that officer it is likely to cause injury to any public person or to lead to a breach of the peace." Further, under Section 125 the Commissioner was empowered to fix by order in writing a period for the withdrawal of the resolution, or during which the district board might agree to refrain from doing a contemplated act, and if, on the expiry of this period, the board had not complied with these instructions he could appoint a person to carry them out in his behalf and realize the expense involved from the refractory board.

3,404. Government were in a position to ascertain that the grants they made to district boards for the execution of public works were spent entirely on the specific objects for which they had been made, through the Inspector of local works. For instance, if a particular district

board had received a lakh of rupees for the construction of a particular road and had diverted to other work out of this lakh a sum of Rs. 25,000, under the Local Self Government Act government were empowered to direct and could force the board concerned to make good this diversion of funds.

3,405. Under the same Act government were also empowered to appoint an auditor to audit the accounts of district boards, and this control had been exercised in that an elaborate set of rules on the subject of the audit of district board accounts had been framed by government. If an auditor objected to a particular item in a board's accounts as unauthorized under the rules, or as requiring the sanction of a higher authority—either that of the Commissioner or of government—that officer pointed out the defect in the audit report and the board was obliged to refer the matter to the Commissioner who decided on the merits of the case whether the expenditure in question might be sanctioned by himself or referred to the local Government. If sanction to particular expenditure was refused, the witness surmised that the board might be called upon to refund the money, but he added that personally he had never known such a case to occur, and that from his personal experience he considered district boards were most reasonable as to the manner in which they spent their grants. Though there had been many instances of purely account mistakes on the part of district boards, e.g., items disbursed without the previous formal sanction of the Commissioner or the local Government, he did not think it likely that a case of real fraud in regard to public funds on the part of a board would ever arise; nor did he think it desirable that, on transferring their buildings to district boards, government should endeavour to safeguard themselves against the possibility of such a case arising, since he thought the general powers of control already possessed by government under the Local Self Government Act were sufficient to prevent this.

3,406. The Superintending Engineer of each circle was *ex-officio* Inspector of local works in the circle, and he was of opinion that the two functions of this officer, viz., that of scrutinizing estimates for works worth above a certain amount, and the actual inspection of works in progress, had been most valuable and desirable. So far as the Patna Division was concerned it had certainly not been his experience that, as had been contended in evidence by a district engineer, the Inspector of local works had not for a considerable period of years either inspected the local works or forwarded to the district engineer an inspection note. He remarked that he did not see how such a case could occur in any division, since the Inspector of local works was obliged under rule to inspect works and submit inspection reports on the work of district engineers to the chairman of district boards, and in addition this officer had every year to submit a confidential report on each district engineer to the Commissioner. The Inspector was also required by rule to inspect the offices of district engineers annually, and this duty had been strictly carried out in his division.

3,407. On the transfer of government buildings to such district boards as were capable of undertaking their construction and maintenance, he advocated, in order to ensure proper maintenance of the buildings in question and proper disbursement of the funds paid by government to the boards, the appointment of an Inspector of Works at the headquarters of each Commissioner's division as the immediate supervising officer over the district engineers. He suggested that the duties of this officer should be to advise district engineers, supervise and control works, and to work in co-operation with the Commissioner in the capacity of his assistant in regard to matters concerning the public works of local bodies, and also to act as an expert adviser to the Commissioner on all professional and technical questions of engineering. He thought that the Inspector of Works should on technical questions relating to works be entitled to issue orders, not through the Commissioner, but direct to district engineers, and that the latter should be required to give effect to such directions subject to a

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[Continued.]

reference to their respective boards ; also that the district board should be empowered to refer to the Commissioner any matter to which they might take exception. In other words, he considered it necessary to give the Inspector of Works not only advisory powers over the district engineers, but also executive power in so far as professional questions were concerned.

3,468. He did not think there was any other direction in which it was necessary for government to take power to ensure adequate control on their part over district boards, and he did not anticipate any difficulty, provided such suggestions as he had made were given effect to, in the transfer of government buildings to the boards which had fully-qualified and competent district engineers on their staffs. He added that one of the results of the scheme he had recommended would be that the Commissioner of the division would be brought into closer relations with the public works of the division than was the case at present.

3,469. He had had considerable Secretariat experience and had been accustomed throughout his service to the present organization under which the Chief Engineer of the Public Works Department was also a Secretary to Government. Hence he was not prepared, on the spur of the moment, to express an opinion in connection with the contention that such a system had resulted in the Public Works Department being less closely in touch with other branches of the administration. *Prima facie*, however, he saw no reason why the Public Works Department should not be run on the same lines as other departments, such as the Police, Jails, Medical, etc., and he did not agree with the argument that it was essential that a trained engineer should deal with the Secretariat work of the Public Works Department on account of its technicality. He did not consider the argument was valid and cited the case of the Sanitary Department, in the case of which questions even more technical in some respects than the work of the Public Works Department were dealt with by an officer who was not also a Secretary to Government. He had had Secretariat experience in Bengal, in which province also the Sanitary Engineer was not a Secretary to Government but used to work direct with the Municipal Secretary, and as far as he was aware no public inconvenience had resulted from the arrangement. He himself had held the post of Municipal Secretary, Bengal, and the incumbent of that post was always a member of the Sanitary Board of the province. A Member of the Board of Revenue was in his time the president of that board, and the Sanitary Engineer to the local Government was the Secretary. In this way the Sanitary Engineer was in constant touch with the Municipal Secretary.

3,470. Commissioners and heads of departments in Bihar and Orissa had powers of administrative sanction, he thought, up to Rs. 5,000. (Mr. Bremner explained that this statement was correct with one exception, viz., that of the Director of Public Instruction, who possessed powers up to Rs. 10,000). He agreed that as a Commissioner he would be able to get through works more easily if this limit were raised, since the required procedure would be simplified. As the present procedure for obtaining administrative sanction to large projects involved delay and unnecessary correspondence he recommended that the limit be increased to Rs. 25,000.

3,471. He believed there were good grounds for complaint by the Public Works Department that heads of departments and others called for the preparation of a large number of unnecessary plans and estimates for which funds were not likely to be available for a considerable period of time, and that as a consequence much of the time of the Executive Engineer and other Public Works Department officers was wasted in the preparation of estimates for schemes that never materialized. From his own experience he was aware that administrative officers frequently called for estimates without considering the question of the provision of funds to meet the outlay they contemplated. But he did not consider the suggestion that instructions should be issued to such officers to the effect that they were not to call for plans and estimates for any work unless it was

exceptionally urgent, or unless they considered that funds were likely to be available for its execution within a reasonable period of time, would be a sufficient remedy, and suggested the addition of a proviso to the effect that the work was within their powers of sanction.

3,472. He had known of cases that had resulted in inconvenience to the Public Works Department owing to insufficient foresight or consideration of original schemes on the part of administrative officers, thus necessitating the preparation by the Department of several detailed plans and estimates, and agreed that it was desirable to impose restrictions on administrative officers in order to obviate frequent changes of this nature. He desired however to draw attention to the fact that there were two sides to the question, and that he did not agree that it would meet the case from the administrative point of view if, after approval to a rough plan was once obtained, administrative officers were not consulted further unless a detailed plan deviated materially from the one such an officer had approved. He thought cases might arise in which the rough plan would not indicate sufficiently the lines on which the detailed plan should be drawn up, i.e., an administrative officer on seeing a detailed plan might discover in it a deviation from the original idea, although it might be technically correct. Hence he suggested that administrative officers should be allowed to see detailed plans, but that they might suggest only such changes in them as professional officers considered it possible to make. He did not think it possible for administrative officers to make their ideas sufficiently clear in all cases by an examination only of the rough line plan. As a concrete example he instanced the case of an office building of his own, and remarked that after passing the rough plan he had gone on leave and another officer had officiated in his place as Commissioner. When he returned he found the building under construction and on its completion he found details put in which, in his opinion and from his experience of the climate and conditions of the province, rendered the building most unsuitable, in fact constituted serious defects. Round holes which it was not possible to close, meant for ventilators, had been made through the walls, and this made it impossible during the hot weather months, when hot west winds were blowing, to shut up the rooms. Not only did the hot air come in through these holes, but dust also poured in. He also found that no venetian windows had been put in to keep the glare out in the glary months of the year, and when he represented the matter, he was told that no change could be made.

3,473. He doubted very much whether a system under which the ordinary annual repairs of government buildings were transferred to the departments in occupation, e.g., under which the Collector was made responsible for the repairs to revenue buildings and the District Superintendent of Police responsible similarly for police buildings, etc., would work satisfactorily, since such a scheme would involve the utilization by departmental officers of the services of local petty contractors without professional supervision. Departmental officers would not have at hand an expert adviser to watch their works in order to ensure that they were being carried out properly from a professional point of view, and he considered professional supervision to be essential, as the petty contractors available in the province were not of adequate status to be entrusted independently with the repairs to buildings. He agreed that the real difficulty in this respect was that the building trades in the province had not progressed up to a stage at which builders might undertake such work without expert supervision, and added that there were no local firms which could be trusted in the same way that firms in England were relied on.

3,474. It had not been his experience that the class of engineering work performed by Superintending Engineers was such as might be easily performed by engineers of the status and qualifications of Executive Engineers; nor that the inspections carried out by Superintending Engineers were not really worth the expenditure incurred on them by government. His

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experience was confined to Bengal and Bihar and Orissa but he had known several cases in which Executive Engineers undoubtedly required supervision to be exercised over them by their Superintending Engineers. He was personally of opinion that Superintending Engineers were far too much tied down to office work, and that their functions should be more exclusively devoted to inspections and supervision. It was true that the direction charges of the Public Works Department in Bihar and Orissa were extraordinarily heavy as compared with those in other provinces of India, on account of the fact that the area of the circles was small and Superintending Engineers controlled very much less expenditure than such officers controlled in other provinces, but the duties of these officers might be devoted more exclusively to inspection and supervision by relieving them of the great mass of desk-work and clerical labour which at present tied them down to their headquarters. He added that if his suggestion was accepted and given effect to the area of the charges of Superintending Engineers might be enlarged.

3.475. Under existing conditions in the province, and with the present class of Executive Engineers, he was not prepared to recommend the abolition of Superintending Engineers on the ground that they were an unnecessary link in the chain of the departmental organization. He thought, however, that it would be quite possible to take such a step if a class of Executive Engineer that might be relied on were secured, i.e., if the present class was considerably improved. This opinion was, however, based on the understanding that the present organization of the Department was to be retained, since, if his scheme regarding the transfer of works to the larger district boards were accepted, both Executive Engineers and Superintending Engineers would disappear and only Inspectors of Works would be required. He added that his scheme did not contemplate the inclusion of irrigation circles.

3.476. In support of the contention in his written evidence that private enterprise was not sufficiently encouraged, he remarked that although the number of private firms competent to carry out important public works was few, and limited, so far as his province was concerned, practically to Calcutta firms and one firm at Muzaffarpur, if such were further encouraged to undertake works in the *mofussil* other firms would spring into being. He added that there were certain Indian firms in Calcutta whom he understood were in a position to carry out public works satisfactorily. To the argument that all public works in the province were thrown open to public tender and that every firm who wished was at liberty to tender for works, irrespective of their size, he replied that he thought the subordinate staff of the Public Works Department threw obstacles in the way of private enterprise being employed on a larger scale, and that it was the duty of the administration, from a political point of view, to encourage private enterprise to a larger extent. He suggested, in order to forward this policy, that works be given out to private firms on condition that they were executed according to specified plans, and that the firms which accepted works on this condition should not be subject to supervision or inspection by any officer below a certain standing. He considered that if a large firm from Calcutta were given a contract on these terms they would be much more likely to take it up and possibly quote lower rates. He added that he had reason for making this statement, and that information he had received was to the effect that the firms objected primarily to inspections by subordinates. He did not think that the course he had suggested would be open to the possibility of bad work being executed as he thought a firm with a good reputation could be trusted fully. He here enumerated as examples several large Calcutta firms to whom in his opinion works might safely be entrusted.

3.477. The remark in his written evidence that "other departments sometimes feel that it would be more expeditious and convenient as well as cheaper to have work executed by other agency" did not denote a desire on his part that departments like the Revenue Depart-

ment or Police Department should be permitted to enter into direct relations with private firms, but that Government in the Public Works Department might have work carried out quicker and more expeditiously in many instances if it were given to large private firms.

3.478. He saw no objection to the utilization of the services of private architects in place of the Government Architect, but declined, on the ground that he was not in a position to express an opinion of value, to state whether when the erection of the New Capital buildings in Bihar and Orissa was completed there would be sufficient government building work available to justify the appointment of a whole-time Government Architect.

3.479. (Mr. Cobb.) He expressed himself as not in a position to remark on the constitution of all district boards in the province since the number of members in different district boards varied. He was acquainted only with the constitution of the district boards in his own division where the public works of each board were carried out more or less by the chairman and district engineer, and he thought this was the case in all districts. The backward district boards were those that were so backward from a financial point of view that with their slender resources they were not able to employ a sufficiently qualified engineering staff. He admitted that if such boards possessed sufficient resources they were likely to go ahead and would not be included under the term "backward." Hence provided sufficient financial aid were given to such boards there was no reason why they should not be able to construct and maintain such government works as might be transferred to them as well as those boards which did not require financial help. He remarked that broadly speaking the backward district boards were those in the Chota Nagpur and the Orissa divisions of the province and that the boards in the Patna, Tirhut and Bhagalpur divisions were among the more developed.

3.480. The fact that the chairman of the district board was usually the district officer influenced to a great extent the standard of public works of a board and caused such works to be executed quite satisfactorily on the whole. In other words, the satisfactory outturn of work on the part of district boards was due to the fact that the executive was in strong and capable hands.

3.481. District board works were occasionally given to outside agency, but in Bihar and Orissa only petty works were so treated. For instance, in the Tirhut Division, north of the Ganges, there were among the indigo planters many old residents whose knowledge of the locality, control and prestige enabled them to have works carried out satisfactorily. Such a course had been adopted only in certain districts where there existed men who were specially qualified, and he did not consider that such a condition of things would extend. He thought it undesirable to entrust members of district boards with the actual construction of works.

3.482. The district boards in the Patna Division had sub-committees for public works, finance and education, and each board submitted elaborate budget estimates every year indicating how they proposed to spend their funds. The Commissioner of the division passed these budget estimates and settled, for instance, a dispute as to which service under the board particular sums should be allotted. The Commissioner had complete control over the board in such matters, and if he considered that sufficient money had not been allotted under, e.g., education, he could, after considering the objections and arguments, direct the board to allot more to this head. The Commissioner's decision was final in all budget matters. He admitted that a resolution of government on the subject of local self-government had restricted a Commissioner's powers of interference with a district board, but explained that this only concerned petty matters. He added that government had reserved a very considerable amount of power in their own hands in that certain limits had been laid down by them in respect to the allotment of district board funds to education and that boards were not permitted to allot less than the specified proportions to these two heads. Further that the Commissioner had power to insist on

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allotments of funds, and that if he, as a Commissioner, found that sufficient money had not been allotted under the head of "arboriculture" for road-side tree planting, he was empowered to return the budget and to direct that additional provision be made. He considered the exercise of this power on the part of the Commissioner to be a matter of vital importance.

3,483. It was not correct to assume that a point would arise in almost every case that was dealt with by the Chief Engineer in his capacity as Secretary to the local Government which would necessitate that officer using his technical knowledge in finding a solution.

3,484. It appeared to him that government had in some cases failed to secure the right class of man for their appointments of Executive Engineer. It was not so much in professional training or general education that the defect chiefly lay as in the moral education and general up-bringing of these officers. It was quite possible, before officers attained the rank of Executive Engineer, to utilize the process of selection more than the process of promotion by seniority as was the general practice at present, and he agreed that this could best be done when an officer's case was under consideration for an acting Executive Engineership. He recommended that character considerations should largely prevail in making a selection, and he agreed that when several men of about the same length of service and status were concerned, a board of appointments might suitably be constituted in order that the responsibility for a decision should not fall on any one particular officer. This board should consult and very carefully scrutinise the character rolls of the candidates from the beginning of their service, as was the practice in other branches of government service. The antecedents of officers belonging to the Indian Civil Service were contained in their annual character reports and were frequently scrutinised.

3,485. (Rai Bahadur Ganga Ram.) There were rules which defined the responsibilities and duties of the Inspector of local works. Under these rules such officers were obliged to make tours of inspection of all local works and submit reports on such inspections. His personal experience of such inspections had led him to form the conclusion that they were useful.

3,486. Orders of government existed which laid down that out of the percentage paid by government to a district board for the execution of government work, the board should not pay more than 5 per cent. to their district engineer. He explained that if a district board did everything from the rough plan to the completion of construction they were allowed 15 per cent., and that out of this percentage they were at liberty to pay their engineer up to a limit of 5 per cent. Hence it was entirely within their powers to give the district engineer any percentage below 5 per cent., or nothing at all.

3,487. There were five divisions in the Province of Bihar and Orissa and he suggested that the Inspectors of Works, whose appointment he had previously recommended, should be officers of the status of Superintending Engineers. Fully qualified officers were essential for these posts, but he did not contemplate their being supplied with a large establishment.

3,488. He admitted that he had been in Bengal before the partition, but did not recollect the experiment that had been pronounced a failure in that province in which all public works, government as well as district works, were entrusted for a time to local board engineers.

3,489. By the remark in his written evidence to the effect that the longer his experience lasted the more he observed that views as to the propriety of particular types of buildings and details of construction were inconstant, he meant that in many cases the standard types of buildings might be improved. He also considered that the present standard types were in several instances more permanent than was necessary. In his opinion it was not so essential to always have entire first-class works constructed. As examples he referred to the residences at Bankipore and suggested that the inner walls of many of these structures might well be composed of masonry that was not first-class in quality.

He omitted police buildings, however, from this category, as he considered that such buildings were generally erected very cheaply in the province by the Police Department. He did not object to the style and accommodation of police buildings, as he thought it essential that policemen should be housed decently.

3,490. He had been informed by firms of high repute in the country that if control and interference by subordinates were withdrawn, it was possible that they would be able to execute work at lower rates, and added that he had very good grounds for believing this statement.

3,491. (Mr. Mackenzie.) District engineers in Bihar and Orissa were divided into three classes and distributed over six grades. Under first-class district engineers were three grades of such officers on salaries which varied according to each grade. The pay of officers in the first grade ranged from Rs. 800 to Rs. 1,000, that of officers in the second grade from Rs. 600 to Rs. 800 and that of officers in the third grade from Rs. 500 to Rs. 600. Under second-class district engineers there were two grades comprising the fourth and fifth grade district engineers, and the salaries of these officers ranged respectively from Rs. 400 to Rs. 500, and from Rs. 300 to Rs. 400. The third-class district engineers included all officers in the 6th grade, who received a salary which ranged from Rs. 250 to Rs. 300.

3,492. If minor government works were transferred to district boards it would certainly result in more work being thrown upon the chairman's office and the district engineer, but he did not think it would make very much real difference in the interest district board members evinced in works, except that such individuals would probably like to feel that they were being trusted by government. He admitted, however, that this sense of responsibility might ultimately beget increased interest in works on the part of district board members. In respect to the boards in his own division, he remarked that the Indian members would probably consider such a transfer of government work to their charge to be an addition to their prestige, but that the feeling that government was putting *begar* on to the boards might possibly be that of the district engineer, the engineering staff and the clerks in the chairman's office whose work would certainly be very considerably increased.

3,493. He was unable to understand how a particular district engineer could possibly have contended in evidence that he had not seen an inspection note written by the Inspector of local works for a considerable period of years, since under rules the Inspector was required to submit notes of inspection, and local officers saw that this duty was not neglected. Further, he believed that ordinarily a copy of each such note was sent to the district engineer direct or to that officer through the chairman of the board.

3,494. If the post of Chief Engineer and Secretary to the local Government were divided into two posts, unless it was possible to join the Secretaryship for the Public Works Department to another Secretaryship, such a division would mean the creation of an extra appointment. He understood that each member of the local Executive Council was in personal communication with the heads of all departments in his charge, whether such officers were Secretaries to Government or not, and he saw no reason why this arrangement should not be allowed to continue. He considered the feeling that, owing to such a system, the Public Works Department was somewhat out of touch with other departments, was due to an idea that that Department's views went direct to the head of the local Government and were not subject to the influence of general administrative opinion. There were many questions in connection with public works matters which were intimately connected with questions of general administration, and ordinary administrative experience might affect a decision on a public works question just as much as it affected decisions on questions concerning other departments; whereas a purely professional view might, under present conditions, achieve its object if it were not checked. He was of opinion that under the present system the tendency

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certainly was towards departmentalism and perhaps toward excessive departmentalism.

3,495. (*Sir Noel Kershaw.*) He confirmed his suggestion that the Inspectors of Works, whose appointment he had recommended in connection with his scheme for transferring government works to competent district boards, should have power to give purely technical directions to district engineers direct, as he contemplated the recruitment of experienced and highly qualified officers for these posts and considered it essential to vest them with this power. Under the present constitution of district boards in Bihar and Orissa he did not think such a course would give rise to objections on the part of the boards, whose members would on the contrary consider it to be perfectly reasonable that a subordinate of theirs should be subject to correction on technical matters even by an officer who was not in their employ.

3,496. In connection with departments of the administration, other than the Public Works Department, where the administrative head was not at the same time a Secretary to the local Government, he remarked that in cases where the heads of departments differed in their views on technical points from their respective Secretaries to Government, it depended entirely on the Member of Council concerned or the Lieutenant Governor as the case might be, to consult the head of a particular department or to decide the point of difference on the papers placed before them. Verbal discussion between the deciding authority and the Secretary to Government was not the usual practice, since Secretaries to Government were also required to note their views on each of their respective cases. He thought it would be advantageous if the present system were altered to the extent that, if one side were heard verbally by the deciding authority, the other side should also be similarly treated. He explained that the present procedure was as follows. Cases were sent from the technical head of a department in writing to the Secretary to Government in that department, and the latter submitted his views in writing to the Lieutenant Governor or Member of the local Executive Council as the case might be, whichever had authority to pass final orders. He admitted the possibility, under such a system, of a Secretary to Government unwittingly misrepresenting a technical point, and also the possibility of the technical head of a department being unacquainted with such a misrepresentation. He considered that both sides should receive a fair hearing and that a technical head should not in any way be placed under a disability. To meet this he suggested that, if the views of such an

officer were not accepted by a Secretary to Government, further opportunity should ordinarily be given the former of being heard.

3,497. (*Mr. Mackenzie.*) A Secretary to Government as such was not the administrative head of any department under the local Government. The term "head of the department" referred ordinarily to the technical head, for instance, the heads of the Jail, Medical and Police Departments, were the Inspector-General of Prisons, the Inspector-General of Civil Hospitals and the Inspector-General of Police respectively. The Lieutenant Governor in Council was the administrative head of all departments under the local Government.

3,498. (*Mr. Bremner.*) The present limit of Rs. 10,000 placed on the powers of district engineers in connection with original works was in his opinion suitable, and he was not prepared to recommend that it might be raised.

3,499. In connection with the limitations it was proposed to place on administrative officers and heads of departments in the matter of the approval of designs and to obviate the necessity for the frequent preparation on the part of the Public Works Department of detailed plans and estimates for buildings, he suggested that, in addition to the ground plan of a building, the elevation drawings might also be submitted with a complete specification noting exactly the size and arrangement of the rooms, the position of doors and windows, the method of ventilation, the type of floors, walls, etc. He considered the supply of drawings most essential as civil officers were not always in a position to understand detailed estimates.

3,500. He did not agree with the contention of a certain architect that engineers should have no concern with buildings except their actual construction, and remarked that it was the officer with local experience of the country who was the best qualified to state what the main features of a building should be.

3,501. He confirmed his contention that the present class of Executive Engineers available in the province could not be trusted to work without the supervision of their Superintending Engineers, and he did not consider that as a class Executive Engineers were any better now-a-days than they were twenty years ago.

3,502. (*President.*) His opinion on the suggested scheme for transferring government buildings to district boards was framed on the assumption that the Collector remained the chairman of the district board, and if a change in this respect were contemplated he would not suggest a transfer at all.

E. G. BRACKETT, Esq., Agency Engineer, Orissa Feudatory States.

Written Statement.

3,503. (I.) *Economy and suitability of methods of execution of public works.*—Present methods are both uneconomical and unsuitable.

3,504. (II.) *Encouragement of other agency.*—Private enterprise is not sufficiently utilized; at the same time the country is not ready or fully enough developed to substitute private enterprise for departmental agency *en bloc*; it would not at present be cheaper or more satisfactory.

3,505. (III.) *Changes in organization.*—I am not aware of what changes have already been recommended. I understood that the Committee was collecting evidence for the purpose of recommending changes. The whole Department requires to be reorganized; very little of the existing organization is of useful quality, for instead of being aimed at the prompt and efficient execution and repair of public works, the chief desideratum seems to be the supply on due date and on correctly coloured paper of numberless figures and forms to one person or another (the chief offender being the Accountant-General's Department) or correct official and departmental procedure. Fully half the Public Works Department engineer's time is taken up with signing his name or some such unproductive office work on this account.

3,506. (IV.) *Relations with other departments and sub-branches.*—I have already stated that the methods

of the Department are uneconomical and unsuitable; it cannot therefore, I imagine, meet the needs of any administration.

(2.) I know very little as to the various sub-divisions of the Department and that only from hearsay; to an outsider, however, there would seem to be a great deal of overlapping which, if it does not lead to friction, certainly does not tend to departmental efficiency. The necessity for the Architect and Sanitary and Electrical Engineers in the Department is not apparent; the first and the last named are specialized branches which could well be left to private enterprise, and the civil engineer can manage the ordinary drainage and sanitation questions arising out in this country—in large towns desiring to have a proper sanitary system it is of course a different matter, but cases of this description are fewer than even in those in which an Architect or Electrical Engineer is required and like them may be handed over to private enterprise to execute.

3,507. (V.) *Decentralization.*—Decentralization is most emphatically desirable in every direction to the extent of reinvigorating the Department and ridding it of the fog of useless clerical and office routine with which it is enveloped.

3,508. (VI.) *Simplification of procedure.*—The Public Works Code is in itself quite sufficient to strangle all initiative, change is required to the extent of abolishing

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the greater part of it, and revising the remainder; but this can only be done if the Department is first reorganized and placed on a business-like footing.

3,500. (VII.) Education, and (VIII.) Practical training.—I have no fault whatever to find with the training given in government engineering colleges of the class of Roorkee or Sibpur. There might with advantage be a six months' practical course at the end, but no longer, as we all learn through life and one cannot hope to turn out the finished article, "the complete engineer" so to speak, in any given time. Experience based on natural aptitude and ability is the only thing of any real value once the grounding has been given. The six months' practical course here advocated should take the form

of putting into effect the previous training of the student and it should very materially influence his final position when passing out whether or not he shows initiative and intelligence in adapting his theoretical training to the varying circumstances of the tasks he is given during this period, as many boys, and Indian boys in particular, can pass book-work tests with flying colours and yet be quite useless when it comes to actual practice of their profession.

NOTE.—I have purposely replied briefly, simply giving my opinions and little more, as I understand from the terms of reference that amplification is not at present required—any detailed evidence in support of opinions expressed, or proposals for remedial measures, will be given orally.

MR. E. G. BECKETT called and examined.

3,510. (President.) The witness stated that he was the Agency Engineer for the Orissa Feudatory States; that he had been appointed by government, but that his salary was met by the States. He had been trained at the Crystal Palace Engineering School and was appointed Agency Engineer in February 1911 on a salary of Rs. 1,000 per mensem. His monthly salary was at present Rs. Rs. 1,500, and he expected eventually to draw Rs. 1,890 a month.

3,511. His duties were not confined only to such States as were under government management, as certain independent Chiefs were also at liberty to utilize his services.

3,512. His duties were connected with practically all classes of buildings and roads and irrigation work, and he anticipated that railway work also would be included in the future. He carried out work by petty contract and the contractors he employed were *kuchis* from the west of India, who were the only class in India which had made contracting a means of earning a livelihood. The families of such men were inter-related and supported one another thus forming a series of firms; for instance, one man's son had become a *bunia* and in that capacity financed several relations. Certain of these contractors were competent to accept a single contract which amounted to as much as Rs. 3 lakhs.

3,513. He had allotted the entire work in each State to one contractor with the object of engendering interest in the work of the States, as if he were to give one contractor a culvert in one portion of a State and another contractor a culvert in another portion, neither would have any interest in the work of that particular State. He admitted, however, that the result of the system was that there was no competition for works, but remarked that the rates at which work was executed were known to him as he prepared the schedules and in so doing was guided by the Public Works Department rates in British India and what he knew represented a fair rate for each item of work. The preparation of a schedule of rates was a simple matter especially in this country where everything done could be thoroughly supervised. The monopoly of the work in a particular State was subject to the satisfactory execution of work, and contractors were changed when they did not give satisfaction.

3,514. The nature of the country in which the Feudatory States lay varied somewhat, and the States were not fully developed. Some of the States along the Mahanadi were fairly well cultivated, but otherwise they were mostly jungly tracts, none of which could be compared to the country which comprised the Province of Bihar. In the circumstances, he considered the system under which he carried out works a good one for country of this particular nature. He questioned the advantages of the competitive system for the giving out of work as it was possible for him to arrive at a fair rate for each item of work, more especially as he had spent several years in the country, e.g., by counting the number of *coolis* that were required to carry 1,000 cubic feet of earth and by taking into consideration the time such men took to do so and the average rate of pay of *coolis* he was able to fix a rate for such work. To the contention that a rate was in most cases fixed after public

competition had indicated it, he replied that it was only possible to have public competition in England or among European firms of repute and that he did not think it resulted in any benefit in India. He was therefore in favour of a system under which a particular contractor would have the monopoly of work in a certain area, subject to the reservation that if his work proved unsatisfactory he would be changed, and recommended that the system might be introduced in all places where Indian labour was employed. For instance, after the rates for the several districts in Bihar were fixed and embodied in schedules, the whole of the work in each district might be given to a particular contractor, subject to the condition that he executed work satisfactorily.

3,515. A bridge over the Bitorana, the cost of which had been met half by government and half by one of the States, had recently been completed by him. The road on which the bridge lay commenced in British India and the bridge spanned a river which was treated as a boundary, and he had suggested that its maintenance should form a Public Works Department charge. There were no government buildings or roads in any of the States.

3,516. Private enterprise might be further encouraged by entrusting reliable firms of contractors with a monopoly of the work in particular areas as long as such firms gave satisfaction. But it was not desirable that any agreement should be drawn up in this connection. Such a system would induce contractors to take an interest in their work, and progress could not be made by simply substituting a European firm of contractors for a certain amount of departmental staff since it would still be necessary to supervise the work of the former.

3,517. He had been employed on railways previous to his present appointment. He had never had actual experience as a contractor for the Public Works Department.

3,518. He suggested a complete reorganization of the establishment of the Public Works Department not only because the office procedure and accounts work absorbed about half the time of an Executive Engineer, but also because that officer had very little to do beyond this work. The staff, too, with which each Executive Engineer was supplied was in his opinion unduly excessive, and he remarked that it was on account of this large staff that a large number of unnecessary forms had to be filled in. An Executive Engineer's staff was very much in excess of any he himself possessed for a proportionate expenditure and the actual quantity of work done by the engineering staff of a division was very small in comparison with the size of the staff. He cited as an instance the work performed by the Executive Engineer at Sambalpur, and questioned its magnitude.

3,519. In his opinion the expenditure incurred by the Public Works Department on establishment was too great as witnessed by the fact that 14 per cent. was acknowledged to be an irreducible minimum by the Public Works Department, but in most cases even this percentage was exceeded and it was seldom under 20. He was here informed that the figure in Bihar was 15 per cent. and that this included direction, superintendence, etc., but not tools and plant and accounts, and that the accounts expenditure at the outside was about 1 per

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[Continued.]

cont., but he still considered that this percentage was too high. He therefore advocated the abolition of the Public Works Department as an imperial department of the Government of India and the substitution in its place of another department with more elastic control. He suggested that the Department might be provincialized and placed under a Chief Engineer, whose headquarters might be at the provincial headquarters, with one or two Superintending Engineers, or Inspectors of Works, who should keep in touch with the Chief Engineer and whose duties should be devoted exclusively to inspection and supervision of the work of executive officers, viz., the district board engineers. In other words he recommended that government should make over all government buildings and roads to district boards and retain the Chief Engineer as a link. He thought such a system would work satisfactorily and remarked that each district board might have an urban area and a country area and that the boundaries of the boards might be co-terminous with each other. Further, that all plans and estimates prepared by district engineers should be subject to the approval of the Chief Engineer, and that two Superintending Engineers would be sufficient for the Province of Bihar and Orissa. In order to meet the difficulty that might arise, if district engineers were employed by district boards, of the latter not being disposed to receive orders from the Chief Engineer, he suggested that the engineers should in technical matters be subject to the Chief Engineer, and subject to their respective boards in matters of an administrative nature. It was true that his system in effect contemplated that a man should serve two masters, but he did not see how it was possible altogether to avoid such a contingency.

3,520. He confirmed the contention in his written evidence that there was unnecessary specialization in the Public Works Department at present, in that there were specialist posts of Government Architect, Sanitary Engineer to Government and Electric Inspector, and suggested the substitution of private enterprise for these officers. He considered that the private firms of specialist sanitary engineers in India might well be entrusted with the preparation of large projects, such as the water-works and drainage of a large town, without any supervision by a Government Sanitary Engineer, and added that firms in England might be requested to prepare detailed plans for such schemes if no firms in India were available or competent to undertake them. He thought also that the smaller sanitary schemes might be entrusted to civil engineers. He admitted, in connection with his suggestion that the Electric Inspector might also be replaced by private enterprise, that he was not aware, when he made this suggestion, that this officer possessed certain statutory functions under the Indian Electricity Act. But though he agreed that a government Inspector was necessary to see that the requirements of the Act were properly met and that the functions of such an officer could not be transferred to a private firm, he was still of opinion that a private firm should undertake the installation of plant, etc.

3,521. By the suggestion in his written evidence that there should be further decentralization in every direction, he desired that the Chief Engineer and Superintending Engineers might be relieved of a great deal of administrative control once administrative sanction had been obtained to works and the budget had been passed. The Chief Engineer in his opinion should form a link between the provincial government and the public works of district boards, should have a seat on the local council and be responsible for all estimates, and once sanction had been accorded to a work by the local Government there should be no further interference with this officer's powers. He surmised that there was considerable interference with the Chief Engineer at present, especially by the Accountant-General, owing to the length of time at present involved in the completion of works. To obviate this he suggested that after estimates were sanctioned sums corresponding to their amount should be placed in the local treasury, and that the Chief

Engineer's cheque on the treasury in payment for the work should be considered as sufficient justification for the expenditure.

3,522. In respect to the suggestion in his written evidence that no student should be given more than six months' practical training, he remarked that if an individual lacked a natural aptitude for engineering, no amount of practical training would enable him to develop into an engineer. He was opposed to students receiving a course of practical training on works for one or two years after their theoretical instruction, and suggested that the practical training might be imparted to them in college. On the completion of the six months in the college, students should be allowed to go out into the world and gain their practical experience as best they could, and whether they succeeded or not would depend on themselves, as they would in any case eventually have to do.

3,523. (Sir Noel Kershaw.) His scheme contemplated a Chief Engineer for each province, and he considered it quite possible for such an officer to be held responsible for plans and estimates which related to an average expenditure of even Rs. 47 lakhs a year, since the district engineers would in all probability send up plans that were in themselves fairly accurate.

3,524. (Mr. Cobb.) As the present prospects of district engineers were insufficient, and as some of these officers were very able men, he suggested that the district engineers under his scheme should be paid a salary ranging from Rs. 300 to Rs. 1,000 or to Rs. 1,200 a month, and that the appointments might be filled preferably by Indian gentlemen with Indian qualifications. He was positive that if the salaries of the posts were made more attractive men of the class he advocated would accept engineer-ships under district boards.

3,525. Each district engineer should have one or two sub-overseers and, if necessary, also an overseer, to assist in the preparation of plans and estimates and supervision, but actual construction work should be given out on contract.

3,526. (Raj Bahadur Ganga Ram.) He was not a member of any institute of engineers, but had been trained at the Crystal Palace Engineering School. He arrived in India at the beginning of 1893, and was for technical purposes under the control of the Political Agent. Such of his estimates as cost less than Rs. 10,000 were checked and passed by the Political Agent, those between Rs. 10,000 and Rs. 25,000 by the Commissioner on his own responsibility, and those over Rs. 25,000 and up to Rs. 50,000 also by the Commissioner after check by the Public Works Department. (Mr. Bremner here, remarked that estimates for amounts above Rs. 50,000 were submitted to government.) The area occupied by the States under his control was about 20,000 square miles.

3,527. In order to facilitate his scheme he suggested that district boards should be graduated and that their district engineers should be appointed by the Chief Engineer who should also have power in respect to the promotion of these officers. He was not in favour of a pensionary fund system for such officers.

3,528. In connection with his suggestion that a monopoly of the work in a particular State might be given to a single contractor, he explained that such contractors should be given to understand that they accepted such work on their own responsibility. No agreement in writing should be entered into with contractors, and it would not necessarily follow that a son would succeed to his father's business.

3,529. He suggested that students might be taught to work independently during their six months of practical training by being given schemes to work out independently, such as a tramway scheme for a town; in short that they should be taught to apply their theoretical knowledge practically. He added that students should not, however, be required actually to execute projects but merely to prepare schemes.

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[Continued.]

W. H. WILLIAMS, Esq., M.L.M.E., MESSRS. ARTHUR BUTLER & Co., Muzaffarpur.

Written Statement.

3,530. (II.) Encouragement of other agency.—Mr. W. H. Williams feels that his views on the subject in question could not be better or more clearly expressed than is done in the Government of India Resolution No. 06-E. A., dated the 24th November 1916 as follows:—

"It is urged that much of the work at present carried out by the Public Works Department could be intrusted to private agency, and that greater economy could thus be secured, and further that much greater use might be made by Government of local bodies, some of which at present employ a skilled public works agency. Much work of a simple and unimportant character which is now undertaken and supervised by highly salaried officers of Government could, it has been suggested, be carried out at reduced cost under contract subject to Government inspection. In the second place it is urged that, if local bodies are encouraged and enabled to arrange more extensively than at present for the execution by

their own staff or by private agency of their works, it will not only be a further step in the direction of decentralization but also would stimulate the growth of firms of standing in the building and allied trades and so encourage further industrial activity. Such developments will further tend automatically to react upon the educational system of the country. A demand for more highly trained engineers in private employ would involve the provision of facilities for the best possible training at the engineering colleges. And it is considered that such provision must be an integral factor in any schemes for the development of private enterprise such as would be connoted in changes of the kind in view."

(2). He further is of opinion that works would be completed with considerably less delay by private agencies, and would also point out for consideration that private agencies would be more likely to adopt the most practical and inexpensive designs in structural work with their most intimate knowledge of manufacturing processes.

MR. W. H. WILLIAMS called and examined.

3,531. (President.) The witness stated that he was a member of the firm of Messrs. Arthur Butler and Company who were private engineers and contractors and had their headquarters at Muzaffarpur and that the firm undertook a good deal of building and brick-making as well as structural steel-work, and possessed a large workshop for the latter class of work. The engineering staff of the firm varied with the works in progress and it consisted at present of six trained civil engineers. Two of these were Associate Members of the Institute of Mechanical Engineers and one was an Associate Member of the Institute of Civil Engineers, while he himself was a Member of the Institute of Mechanical Engineers. The firm had been established for the past 50 years, and was, he believed, the only firm of contractors in Bihar which employed a trained engineering staff.

3,532. The firm had had considerable experience of Public Works Department work. He was not prepared to go so far as to recommend, in the interests of private enterprise, as had been suggested by one of the witnesses, that a firm of contractors should be given a monopoly for all work in a particular district so long as they continued to give satisfaction, but thought that it would be beneficial to India if firms could be encouraged to become firms of standing. With this in view he suggested that the work which was at present executed by the Public Works Department might gradually be made over to private firms, and remarked that India could not be developed industrially unless private firms were encouraged in this manner. Hence the only practical method of offering encouragement was by the gradual reduction of the Public Works Department. The Department had done noble work and the country could not possibly have done without it at the commencement. There were, as a matter of fact, still many districts which required the services of the Public Works Department, but there were on the other hand others which could manage without the Department. He did not agree fully with the view that Public Works Department subordinates were one of the drawbacks to the encouragement of private enterprise though he considered the employment of these men made it a little more difficult for contractors. It was true that in order to effect supervision it was necessary to include a certain number of subordinates in the supervising staff, but it would greatly encourage private enterprise if a substantial improvement were made in the class of subordinates now employed by the Public Works Department, though it would be difficult to effect such an improvement all at once.

3,533. The system followed by the Public Works Department of obtaining bricks from one contractor and giving out the contract for actual construction of the building to another greatly discouraged private enterprise, and had been much condemned in recent years.

It was not beneficial nor economical in any way and certainly discouraged firms such as his. He was opposed to the practice of giving a contract for the manufacture of bricks to one contractor in the one year and the contract for construction to another contractor in the succeeding year, as he did not regard it as economical and considered it was preferable to give out entire contracts for buildings, including the materials required therefor, once and for all. The Department doubtless encouraged private enterprise by inviting tenders for works, but they also included a proviso that they were not bound to accept the lowest or any tender. It was true that this proviso should exist from a legal point of view, but a result of its retention was that it was generally decided to whom a work was to be given before calling for tenders, and this caused unnecessary trouble to the other tenderers. If a reliable firm put in a tender for a particular building it was not necessarily accepted on its merits. In the circumstances, he advocated that provided a firm was reliable and the Department had nothing against it the lowest tender should be accepted.

3,534. Broadly speaking, as there was a great deal of overlapping at present, he recommended that the Department should be carefully but very considerably reduced, until it finally disappeared, by giving more extended powers to district boards. He made the recommendation as private enterprise could not be encouraged as long as a government department existed for the construction of public buildings, and as the system at present in vogue did not exist in more advanced countries and was bound to disappear with the eventual development of the country. He added that the present system interfered too much with private enterprise.

3,535. He also advocated that works in large towns, e.g., Calcutta, Bombay, Madras and other cities and provinces which were sufficiently advanced and where reliable contractors were available, might be given to private contractors subject to supervision by government, thus reducing the enormous establishment at present entertained. In reply to the contention that there were not sufficient firms of standing to justify the change he had proposed he stated that such firms would have to be created and could not spring into being as long as the present system existed, e.g., his firm could not afford to employ an architect under present conditions unless the work of designing government buildings were entrusted to it. It was preferable, in his opinion, to have a number of architects imported by private business firms doing government work rather than a single government Architectural Department, as the ideas of the former would be more versatile. Apart from this, government, by the adoption of his suggestion, would be able to get their designs prepared cheaper by private agency and the charges of firms would in no way exceed the cost of employing a Government Architect. In cases, where

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[Continued.]

firms were given the construction of large works as a whole they would be prepared to have buildings designed by their architects free of charge, but in cases where this was not possible fees would be charged for the preparation of designs. He did not think that contracting firms would under his proposal be able to run up the cost of buildings, as such a tendency could be checked by the government supervisory staff and by competition.

3,536. (Mr. Cobb.) There would be no great danger in introducing the scheme he had advocated in cities like Calcutta, Bombay and Madras and government would be able to have their work done as economically and efficiently as at present. If one contractor proved a failure government could employ another, but government would have to be prepared to run some risk in this connection if they desired to develop the country.

3,537. Large lump sum contractors were discouraged by the impression that the Public Works Department preferred petty contractors to them.

3,538. It was the general impression that the selection of contractors was made prior to the call for tenders, but he preferred not to discuss the question as to who selected contractors.

3,539. (Rai Bahadur Ganga Ram.) He was doubtful whether 10 per cent. was the margin of profit allowed by the Public Works Department to a contractor, but mentioned that his firm had been allowed 12½ per cent. for certain works in Pusa on the actual cost of labour and materials. This margin of profit was not sufficient in the case of small works, but was adequate enough to induce large contractors to take up big works provided an excessive supervisory staff was not required.

3,540. The firm had been established for the last fifty years at Muzaffarpur, and had not tendered for works in the New Capital as public tenders had not been invited. The profit allowed on these works was 2 per cent. on account of tools and plant, 5 per cent. for establishment and 10 per cent. for ordinary profit or 17 per cent. altogether and his firm would have been glad to have had the opportunity of competing on these terms.

3,541. A number of large contracting firms were being

*Mr. Williams afterwards wrote that he was in England a good deal at the commencement of the work and that he had subsequently found that the firm was asked to tender for 6 sets of quarters, at the very beginning of operations, which it was stipulated should be completed in an impossible time under a heavy penalty clause and that the firm were in the circumstances unable to tender. He added that the quarters were not eventually completed in the time given to the firm.

established in big towns. He could not believe that their rates were approximately 30 per cent. higher than the Public Works Department rates provided all charges for establishment were duly charged, as it would be impossible for these firms to get on if their rates were so high.

3,542. (Sir Noel Kershaw.) The supply to contractors of bricks and other materials favoured petty contractors at the expense of big contractors, as the former had no funds and could obtain bricks without payment.

3,543. He recommended that, in order to encourage large contractors, government should at the start be prepared to incur an expenditure of anything between 10 to 15 per cent. more than they incurred under the departmental or petty-contract systems. He had been in India for a long while and was of opinion that government could not develop the country unless they went out of their way to do so. The ultimate results would, however, justify the increased expenditure.

3,544. (President.) His firm tendered at rates based on their own analysis of the specification for each item of work, but Indian contractors invariably tendered at a percentage below the Public Works Department rates, and this practice applied also to piece-work agreements.

3,545. From his experience of 25 years he could say that the firm's rates for piece-work had never been in excess of the Public Works Department estimated rate in any work of importance. The firm were content to work at the Public Works Department rates which were usually reasonable.

3,546. The firm were not cognisant of the Public Works Department sanctioned rates before submitting their tenders, as no notices were issued nor were the tenders advertised in the papers. The Executive Engineer's office in Muzaffarpur was situated in a garden and more resembled a private dwelling than a public office, and sufficient publicity was not given in inviting tenders. As far as he was aware the practice was to write to firms whom it was desired should submit tenders. This applied at least to Muzaffarpur and the firm had practically to wait till they were asked to submit a tender. (Mr. Bremner explained that tenders for minor works under Rs. 10,000 were not advertised, but that all major works in excess of that amount were advertised. The general order was to insert advertisements in the local newspapers and the customary practice was to insert advertisements in one paper in Cuttack and one in Bankipore. The witness here pointed out that this was not the practice in Muzaffarpur, but admitted that his firm did not obtain all the newspapers.)

At Bankipore, Tuesday, 27th March 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., I.C.S. (President.)

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

W. S. BREMNER, Esq., Superintending Engineer, Public Works Department.

D. G. HARRIS, Esq. (Secretary.)

A. N. MCINTYRE, Esq., A.M.I.E.E., Electric Inspector and Electrical Engineer to the Government of Bihar and Orissa.

Written Statement.

3,547. (I.) Economy and suitability of methods of execution of public works.—As a specialist in the Department I have had very little working experience of the methods generally adopted in the execution of works, but they appear to me to be necessary and suited to the conditions of the country.

3,548. (II.) Encouragement of other agency.—In the case of electrical works I think private enterprise is sufficiently encouraged. All new construction is done by contractors and the maintenance is done departmentally with stores obtained through contractors. In my experience it is necessary to employ departmental labour on maintenance.

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[Continued.]

3,549. (V.) Decentralization.—With a view to overcoming the difficulty that is often experienced in spending allotments within the prescribed time I think it desirable that executive officers should have power to transfer funds from one work to another. Money is often wasted

in rushing a job merely in order to spend an allotment in time, and there must be cases where an executive officer surrenders money saved on one work and is obliged to suspend work on a tenth for want of funds:

MR. A. N. MCINTYRE called and examined.

3,550. (President.) The witness stated that he was the Electric Inspector to the Government of Bihar and Orissa and that he was in his 16th year of service. He had been appointed in India and trained at the Sibpur Engineering College, at which institution he had specialized in electricity. He added that he was selected by Mr. Meares, then Electrical Engineer, Bengal (and now the Electrical Adviser to the Government of India) to act as his Assistant on the completion of his training at Sibpur, and that he next held the post of Junior Electric Inspector, Bengal, for a period of ten years, at the close of which he was promoted to an inspectorship under the Government of Bihar and Orissa.

3,551. He had no electrical staff. In addition to himself there was one electrician of the supervisor class in Bankipore who looked after the maintenance work under the orders of the Superintending Engineer and Executive Engineer concerned. The electrician had not received any theoretical training and had acquired his knowledge with wiring contractors and in workshops.

3,552. His chief statutory duties as Electric Inspector under the Indian Electricity Act were in connection with the use of electricity in mines. There were about 30 electrically-installed mines in the province. In addition there were factory installations at the Jamalpur railway workshops, the tobacco factory at Monghyr, and a factory in the coalfields; also a semi-licensed undertaking in the coalfields which was distinct from installations in the coal mines. The under-ground electrical work in the mines had been taken over by the Mines Department, and it had been contemplated at one time to place the above-ground work also in the charge of that department. The proposal had originated with the Chief Inspector of Mines, who desired to employ an official belonging to the Mines Department on all the electrical work in the mines. But the Government of India had not agreed to it, and the existing arrangement under which he attended to the electrical work which was above-ground had been arrived at at his suggestion, and he considered this plan the only feasible solution that could have been arrived at. Hitherto he had devoted comparatively little time to his statutory duties in connection with the mines, because he had been kept busy at Bankipore, and the total amount of his time that was ordinarily occupied by such duties was only about one-fourth. His duties under the Indian Electricity Act were also advisory; for instance, if a license came up for consideration he advised the local Government on its technicalities and generally also on its legal aspects. It was true that the Government Advocate was consulted on the legal aspects of some cases, but cases were ordinarily referred to the Electric Inspector. His executive work comprised the execution of all original works, and inspecting and advising on the working of the several government installations in the province. These latter consisted of small electrical plants at Puri, Ranchi, two at Gaya and four in Bankipore, which were all separate small power plants which had been put down from time to time. In addition there was the installation at the Agricultural Research Institute, Pusa. He added that the installation contemplated for the New Capital would be a fairly large one, and the work in connection with it was in progress. He was not in executive charge of any of the installations at present but a proposal was under consideration for putting him in executive charge. Since his statutory work absorbed about a quarter of his time, it could reasonably be assumed that at present the remaining three quarters was occupied by his executive work, as everything in the province was in its incipient stage.

3,553. As there were no licensed electricity supply companies in Bihar and Orissa, as there were in the other

provinces, he did not think that the objection advanced elsewhere to an officer exercising functions under the Indian Electricity Act in addition to his duties as an executive officer of government was applicable to Bihar and Orissa. He was of opinion that there were grounds for taking exception to the arrangement under which the government officer's duties were statutory as well as executive as cases might occur where the Electric Inspector might be called in to give a decision against himself. For instance, that officer might have executed a work and had it connected by a supply undertaking who had complained that the work had not been carried out in accordance with the rules the Electric Inspector would then have to take up his own work. But the possibility of such clashing was very remote. He had not himself had experience of such a case, but it was possible, and if it ever arose it would be between the Electric Inspector and a supply company and not between that officer and a contractor.

3,554. If all the above-ground electrical work of the mines were removed from the charge of the electrical officer in Bihar and Orissa, it would still be necessary to retain a qualified electrical engineer since it was necessary to appoint to such a post a man who was more qualified than an electrical supervisor as the latter was not competent to run works economically. Apart from this the existing government installations justified the employment of a fully qualified electrical engineer, more especially since additional expense would have to be incurred in providing more power in future.

3,555. The construction of electrical works in Bihar and Orissa was ordinarily entrusted to private electrical engineering firms, and he split up the contracts under the heads—(1) plant equipment, (2) overhead equipment, (3) internal wiring, (4) lighting fittings, (5) fans and regulators. He separated the contracts in this way in order to secure the quotation of fairly uniform prices. Each of the firms supplied particular types of fans at different prices, and as he was acquainted with them all he knew which type was the most suitable. He did not think this object could be met by a specification attached to the inquiry as he was not in a position to specify, for instance, a particular make of fan and he had to select from standard designs on the market in view of the expense of having special fans made. Neither did he think it advisable to give the entire contract to a particular firm because if such a contract were given to one firm and he required fans made by another, the former firm would have to pay the latter very much more for their fans than he himself would be charged as Electric Inspector if he purchased them direct. He therefore considered it desirable from the government point of view and in the interests of the electrical industry in India to split up electrical contracts. He added that government were in a position to pay for the best material, fittings, fans and workmanship procurable and to ensure this it was necessary to split up contracts and to deal with recognised firms.

3,556. There were no local electrical firms in the province. One firm had started a business but had not been in a position to show the witness the quality of their work. Contracts were only given to approved firms and the firm that offered the best value (not necessarily the lowest tender) was generally selected. The final acceptance of tenders did not rest with him, but with the Chief Engineer to whom he submitted his recommendations.

3,557. Electrical repairs were ordinarily carried out departmentally, and in Bankipore they were in the charge of an electrician. This officer was subordinate to the Executive Engineer of the Special Works Division and for work in the Patna Division subordinate also

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to the Superintending Engineer. A proposal was, however, under consideration to place the electrician under him, from the 1st of May and he considered this was the proper course to adopt.

3,558. He advocated that he should be given full executive powers and be supplied with a staff directly responsible to himself. Such an arrangement had originally been contemplated for him, but he had not been in favour of it until he had become settled in his appointment.

3,559. The repairs to the installation in Ranchi were undertaken by the local sub-divisional officer who had a staff of electrical wiremen. This sub-divisional officer had had an electrical training. A whole-time electrician attended to the work in Gaya and he was attached to the Jail Press. At Puri the repairs were entrusted to a contractor as the installation was only used for a couple of months in the year.

3,560. The execution of repairs departmentally was preferable to the employment of private firms for the purpose, as it was impossible to bind firms to a particular figure and there were a large number of contingent items in electrical work which made it very different from ordinary building repairs. Further, there were no means of checking what electrical repairs had been carried out, with the result that if for example a firm alleged that they had repaired a particular fan their statement would have to be accepted.

3,561. All stores required for repair works were purchased from electrical firms in Calcutta, and he did not as a rule indent on the Secretary of State for any of such stores. This arrangement was satisfactory and it was possible under it to secure stores as cheaply as they could be obtained from England. One of the advantages in dealing with a local firm was that it was possible to induce them, if anything went wrong, to put things right, whereas such a procedure was next to impracticable when dealing with the Secretary of State. In certain cases in which he had indented on the India Office for instruments, his indents had not been satisfactorily complied with, but as he had not had much experience in obtaining articles through the Secretary of State he had not actually effected a comparison between the cost of such articles and those purchased locally.

3,562. There was no testing laboratory in Bihar and Orissa and one would not be required until a license was issued in connection with the supply of electricity. Most of the testing work of a laboratory would be connected with licensed power supply schemes and would comprise the settlement of meter disputes, etc. He possessed a portable testing equipment for his ordinary work and had found it to be sufficient for his purposes.

3,563. Lapses of grants at the end of each year hampered work considerably. This applied not only to present but also to normal conditions. Works were occasionally held up for want of funds, while others were rushed through at enhanced rates in order to obviate a lapse of a grant, and he considered it would be to the interests of government to vest in the executive officer the power to transfer money from one work to another and thus enable him to utilize his grants to the best advantage. Under present conditions unspent balances could not be carried over to the following year, and the reappropriation of funds always involved trouble and delay with the result that an article that was needed very urgently might be purchased by someone else, or the rates might have been enhanced before the sanction was received. The recommendation he had made would enable him to purchase material, as it was available and needed for one work from the money allotted to another, a fresh allotment of funds being provided later to cover the deficiency in funds. He added that as electrical material, particularly copper, was continually varying in price he desired to be in a position to purchase it immediately on receipt of a quotation and not be obliged to await orders.

3,564. The recruitment of electrical engineers with Indian experience was a distinct advantage to government. He had known men who had been recruited from England, at a time when they were unfamiliar with the

country, and observed that they did not know much about Indian conditions for the first two years at least. He admitted, however, that the ordinary training received by an electrical engineer in England was superior to that given to such officers in India.

3,565. The question whether there was a sufficient supply of electrical engineers in India to justify the recruitment of such officers in the country depended on the class of work they would be expected to perform. In his opinion Electric Inspectors could be obtained from among the private electrical engineers in practice in India, and he advocated that government should first endeavour to obtain men locally for vacancies which might occur before applying to the Secretary of State, as it was desirable to secure men with Indian experience.

3,566. He was not in favour of permanent employment as he did not consider there were any advantages in a pension. He was more in favour of the agreement system which was at present in force as it was fair both to government and the officer, and it admitted of either party withdrawing in the event of dissatisfaction. In the circumstances, he did not agree with the contention of other electrical officers that they should be given permanent and pensionable appointments. He himself held a temporary post on a five years' agreement and subscribed towards a provident fund and considered the arrangement a suitable one. He admitted, however, that the fixation of the pay of each officer under a five years' agreement was necessarily in the nature of a bargain with each individual. It would be of advantage if transfers between provinces were made permissible, and a general reserve might be created with this in view for the purpose of filling leave vacancies, etc. He was not in favour of an imperial service of electrical engineers to be controlled by the Electrical Adviser to the Government of India.

3,567. He had no official relations with the Electrical Adviser to the Government of India, but the local Government could if occasion arose request the latter officer to check his work or offer him his advice. Such a step however was entirely at the discretion of the local Government, and he was not required to submit his schemes for the approval of the Electrical Adviser. Very few electrical questions were referred to the Government of India by the local Government and the electrical work in the province was practically self-contained.

3,568. (Sir Noel Kershaw.) He stated that while the two provinces of Bengal and Bihar and Orissa were under one Inspectorship, the services of the Electrical Adviser to the Government of India had been requisitioned to prepare a scheme for electricity supply in the New Capital, Patna, but his scheme had not matured.

3,569. He adhered to his contention that local talent should be given the preference on the occurrence of a vacancy in the post of Electric Inspector. It was true that by such a procedure government might reap an advantage at the expense of private firms who had trained their employees, but it might so happen that the selected individual was on the point of returning to England at the time of the occurrence of the vacancy, and that a private firm would be only too glad to secure a government appointment for such a man. The possibility of obtaining government employment would not, however, act as an incentive to individuals in England taking up employment with private firms in India, as there were very few electrical appointments in government service. In other words, since there were so few appointments available, men in England would not be encouraged to join private firms in this country merely with a view to securing a government appointment later on.

3,570. Most of the electric fans used in India were of American manufacture and only one or two makes of British fan were available. The firms in India who sold fans were purely agents for their sale and there was a great deal of rivalry between them as to the respective merits of the particular fan they each stocked. As a result of this, if one firm went to another for a particular type of fan that was required for a work, the latter

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firm invariably took advantage of the opportunity and charged the former a higher price than they usually charged him as Electric Inspector, and it was for this reason that he avoided specifying particular types of fans in contracts. There were no manufacturing firms in India, and the agents for the sale of the fans were each interested in maintaining the merits of the particular type they stocked. The fans he used were usually worth about Rs. 100 and he had made it a practice to separate the tenders for fans and for fittings from those for wiring. He admitted that the above system might not be the most economical, but added that it enabled him to deal directly with the supplying firms for each particular type of fan or fittings and thus be sure of what he secured.

3,571. (*Rai Bahadur Ganga Ram.*) If the duties of the Electric Inspector were confined to the administration of the Indian Electricity Act, it would not be possible to retain this officer on less than Rs. 600 to Rs. 1,000, the usual salary of the appointment, as the duties involved experience and considerable responsibility.

3,572. He had attended both the electrical conferences which had been held in Calcutta, and considered that they were advantageous in that they enabled electrical officers to learn of what was taking place outside their own jurisdiction. The conference had received official recognition.

3,573. He had not constructed or designed a hydro-electric scheme and his ability to do so would depend on its magnitude.

3,574. He was permitted to accept fees for private work provided he obtained sanction to their acceptance.

3,575. All electrical stores were exempt from the rules in the Public Works Department Code regarding the purchase of stores, since everything below a capacity of 10 or 25 kilowatts was excluded.

3,576. In spite of the march of progress in all directions and the fact that electricity was a progressive science, he considered that such advances as were made from time to time were not so serious as to point to the necessity of using the agency of the Director General of Stores in the purchase of electrical stores, and he could keep himself sufficiently informed of the latest developments in the market through the technical press.

3,577. (*Mr. Cobb.*) He had received his electrical training at the Sibpur College under Professor Bruhl who was responsible for the electrical section in that college, but he admitted that he had much to learn when he first left college, which he pointed out was the case with all engineers when they first left college. He was of opinion that he had been well instructed at Sibpur in the fundamental principles of electricity.

3,578. An attempt had been made to give an entire project to a single contractor and not to invite separate tenders for equipment, wiring, fittings and fans, but the experiment had not proved satisfactory. It was

because of this that he did not consider the giving out of entire projects to one contractor a satisfactory method of executing work. Besides, tenders on a uniform basis could not be obtained without separating the several main heads of works in the manner he had explained.

3,579. He generally obtained quotations for fans from four firms in particular, and if one of these could not supply him, he resorted to another. To give the same contractor the contract for wiring as well as for fans might lead to greater expense as such a contractor, if he did not deal in fans, would obtain the fans as a middleman and would naturally charge a percentage for the accommodation. He not only purchased direct from the firms who supplied fans, but also insisted on their erecting the fans they supplied. In this way he was in a position to insist on a contractor replacing a defective fan, whereas if one firm put up fans supplied by another and they were found to be defective the former would not accept the responsibility for the suitability of the latter's fan.

3,580. There was a distinct division between the work of the wiring contractor and the firm which erected fans, as wiring always ended at the ceiling-rose. Hence when the work of wiring was completed, the erection of fans commenced.

3,581. He had hitherto had very little connection with the maintenance of the electrical installations at Ranchi and other stations, as the Public Works Department attended to this work departmentally. The Department obtained the necessary equipment by local purchase and referred to him, when necessary, for his advice. The major portion of his time was spent on the installations at Bankipore and on the works that were contemplated there.

3,582. He was competent finally to decide certain disputes under the Indian Electricity Act; and in others appeals against his decisions could be made to the local Government.

3,583. (*Mr. Bremner.*) He believed that the contract for the electrical installation at Puri had been given out by the then Chief Engineer, but mentioned that this had occurred at a time when there was no separate Electric Inspector in the province. It was true that the entire contract in that case had been given to a single firm but the work in question was a small one.

3,584. His difficulty with regard to lapses occurred at the close of the year, and though it was possible for him to obtain orders by telegram from the Chief Engineer in cases of emergency such a course would involve some delay and it would of great advantage if the executive officer were given power to transfer funds himself and he should be made responsible for the best application of all the grants allotted to him. The Finance Department of the local Government had no voice in the reappropriation of funds from one work to another.

The Hon'ble KHAWAJA MUHAMMAD NOOR, Vice-Chairman, Gaya Municipality.

Written Statement.

3,595. (I.) Economy and suitability of methods of execution of public works.—The methods at present adopted for the execution of civil works are on the whole fairly economical and suitable as far as actual cost on the work is concerned. Of course some more decentralization is required. I understand that at present even for small repairs and petty works a good deal of correspondence has to be carried out and this causes undue delay and inconvenience.

(2.) I have experience of the *mofussil* only where the Public Works buildings and roads are much scattered and are not very large in number. I do not think much improvement can be done by any change in the system except so far as I have indicated in my answer to question number 11. It is said that the buildings constructed by the Public Works Department are rather expensive. But a closer scrutiny will show that the buildings now constructed are far better than the old

buildings. Much attention is now paid to stability and style.

(3.) The buildings now constructed in the New Capital are, however, being very much criticised. I would suggest that if any building of importance is to be constructed its requirements, etc., should be published and plans and estimates be invited from the various firms and a reward be offered for a successful plan and design.

3,586. (II.) Encouragement of other agency.—I do not think it is possible that scattered buildings in the *mofussil* can be left to be constructed by private engineering firms. Very few firms are available in the *mofussil* and unless the work is very large, engineering firms from Calcutta or other places cannot be expected to take it up. I am of opinion that when there is any large work to be constructed, say, exceeding one lakh in estimate, private engineering agencies should be employed. I think respectable firms from Calcutta will be willing to take them up and this is likely to give impetus to the establish-

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ment of new engineering firms in the province also. The firms should be required to submit for approval their own proposals and designs. They should not be handicapped by hard and fast details supplied by the Department. This, I believe, may lead to more economy and help private enterprise. I am also of opinion that the repairs of the existing buildings and roads and the construction of smaller works can safely be done through the agencies of municipalities and district boards under the supervision of government officers. The government should make specific terms with each individual local authority. The first condition should be that the particular local authority should employ a staff of particular qualification and that before employing an officer the opinion of the government officers should be obtained. This will have two advantages: (1) government works will be done more cheaply and it will involve the curtailment of many subordinate staffs, and (2) it will give some help to the local authorities and they will be in a position to maintain better paid and better qualified officers which they cannot at present for want of funds. It may also be desirable to provincialize the engineering staff of the local bodies. There should be a central authority which should supply officers to those bodies and in extreme cases should have power to transfer an officer from one place to another place.

3,587. (III.) Changes in organization.—If the above proposals be accepted the number of officers below the rank of Superintending Engineer will have to be reduced.

The Hon'ble KHWAJA MUHAMMAD NOOR called and examined.

3,592. (President.) The witness stated that he had had experience of public works undertaken by municipalities as a municipal member and as vice-chairman of the Gaya Municipality. He had also had experience of district board work as a district board member, but had had very little connection with the Public Works Department. The views contained in his written statement were therefore based on his experience of district boards.

3,593. The buildings connected with the New Capital at Bankipore had been much criticised by the public who considered they were inferior from the aesthetic point of view. The general public had expected to see buildings of a much more imposing appearance erected, and objected principally to the style of architecture that had been adopted. They also questioned the stability of the buildings since cracks had occurred in some of those connected with the High Court. Those criticisms had however been expressed by laymen, and not by professional engineers. He had seen the large palace that the Maharaja of Darbhanga was erecting just outside the city when the superstructure was being built, but did not approve of that style of structure. In his opinion, the New Capital buildings compared unfavourably with "Bolvedero" and Government House, Calcutta.

3,594. He considered that large building works should be entrusted to large engineering firms whenever such firms were available, and admitted that the High Court buildings at Bankipore had been constructed by a large Calcutta firm of European contractors. He was then informed that this particular firm had also undertaken the construction of several other large buildings in the New Capital. He did not agree with the contention that the extension of the system of employing large contractors would be prejudicial to the prospects of small Indian contractors but thought that it would rather give an impetus to the latter as, whenever a commercial business was started by Europeans, though they might lead for some time, Indians eventually usually followed in their wake. He was only aware of one firm of large contractors in Bihar and Orissa. This firm was established at Muzaffarpur, and had accepted work from the district board of his district.

3,595. The construction of small government buildings and all repairs to government buildings should be entrusted to district boards, subject to the supervision of government officers. All local bodies did not have

3,588. (IV.) Relations with other departments and sub-branches.—The Public Works Department gives no help to the municipality and I have no experience of other departments.

3,589. (V.) Decentralization.—It is believed that some decentralization is needed and the Public Works Code is too restrictive.

3,590. (VI.) Simplification of procedure.—I am unable to give the details of the changes required as it is a matter for departmental consideration.

3,591. (VII.) Education, and (VIII.) Practical training.—My own experience is that the students who come out from the present engineering colleges and schools are not in the beginning quite suited for municipal works. They seem to have very little knowledge and experience of the particular works required by the municipality, such as of town roads, drains, sewers, septic tanks and water-works. I do not know particularly, but most likely there seems to be very little provision for teaching sanitary engineering. Practically we have to train our own officers and, the municipal services not being very attractive, officers go away when they get better prospects elsewhere. We find some difficulty in getting Indian mechanics for employment as water-works superintendent, etc., and the class of people we get sometimes become unmanageable under the lay officer of the municipality.

qualified engineers on their staffs, but his own district board had a qualified engineer in charge of their works. If district boards were paid a percentage to cover the cost of maintaining the establishment necessary for the supervision of such works, they would welcome the transfer to their care of the works he had recommended as it would enable them to entertain a better paid staff and offer them better prospects. The fact that the boards would make no profit by accepting such works would not influence their decision in the matter, nor would they think that government were trying to put some *begar* upon them. As a result of such a transfer of work, savings would be effected in the engineering establishments at present employed in the districts, since only one such establishment, instead of two, would be necessary for the supervision of works, under an engineer of higher rank.

3,596. In connection with the suggestion in his written evidence that government should, on transfer of its works to district boards, control the latter by prescribing the qualifications necessary for the appointment of district engineers he admitted that government already possessed this power of control to a certain extent, but explained that it might be necessary to increase it in certain circumstances, e.g. in order to secure more fully qualified engineers. He admitted however that his contention would be met if the appointment of district engineers by district boards were in each case made subject to the confirmation of the Commissioner of the division concerned.

3,597. Service under both district boards and municipalities appeared to him to be unattractive and to offer no prospects to engineers outside the area controlled by each of these bodies, e.g. an engineer employed by a second-class district board could not be assured that, if a vacancy arose under a first-class district board, the members of that board would consider his claim *thoroto*. Hence he considered that government should in exceptional cases retain the power to transfer a district engineer from one district to another, and was of opinion that it would be possible to recruit better qualified officers than were secured at present under such a scheme, and that, provided the power he advocated was exercised judiciously by government it would be advantageous to district boards. By this he meant that if a vacancy occurred in a first-class district the claims of not only one, but of two or three qualified engineers in second-class districts should be considered by government, the

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district board in which the vacancy had occurred being allowed the option to make its own selection. A district board would be wise if, instead of expressing a desire to import an outsider with no experience of district work, they accepted an engineer put forward by government, even though such an officer had had experience only of work in a district of lesser importance than their own. It was true that members of district boards might to some extent view the government control over the appointment of district engineers as a restriction on their power of selection, but the system would on the whole be advantageous, since district board members themselves were laymen and were not in a position to discern the merits or demerits of the qualifications of three or four candidates. He modified his recommendation, however, on re-consideration, to the extent that he did not desire to suggest a wholesale change, but that the experiment of handing over government works to district boards might be introduced with caution, buildings in districts in which there were already highly qualified engineers being transferred for a start.

3,598. He agreed that the employment of an Inspector of Works would be necessary, and suggested that as the Superintending Engineer was already required to inspect district board works he might attend to this duty as well as the inspection of government works during the course of his tours. The Superintending Engineer did exercise some control at present over works, as he had personally seen certain recommendations and decisions of such officers on plans and estimates prepared by district engineers.

3,599. Works were undertaken by the district board staff on the initiation of the district engineer, who prepared a list of suggestions. These latter were placed before the board not only at the time of the budget assembly but also during the course of the year whenever the necessity for a particular work arose. The rough estimates of the district engineer were examined by the public works and finance committees of the district board before sanction was accorded to them by the board as a whole. In the case of an educational building, the estimate of the district engineer was scrutinised by three sub-committees, viz., the educational, the financial and the public works.

3,600. The interest evinced in a work by the several members of a district board depended on its nature, e.g., if the construction of a road connecting the portion of the locality in which he resided came up for consideration he, as a district board member, would take an interest in this particular work, and similarly also in the case of a school building which it was proposed to erect in the neighbourhood.

3,601. After sanction had been accorded to a district board work, the district engineer invited tenders from several contractors and as a result of the examination of the tenders suggested the name of one contractor to the board in the case of small works, and the names of more than one in the case of large projects. He believed that the opinion of the Superintending Engineer of the circle concerned, as Inspector of Local Works, was also sometimes invited in the latter case. The final selection was made by the finance committee of the board subject to the approval of the whole board, and the recommendations of the district engineer were in practice generally accepted. The contractors usually engaged were local men, who were chiefly suppliers of labour. Though he had known of complaints having been made against particular selections, the district engineer usually did his best to distribute the board's work amongst the several contractors that were generally employed. Contractors did not frequently canvass for votes on their behalf at district board meetings, but when a work with a large margin of profit was under consideration they usually interviewed the members with whom they were acquainted and put forward their claims. He was of opinion that, on the whole, the selection of contractors was made satisfactorily.

3,602. He recommended the extension to selected municipalities of the experiment of transferring the con-

struction of small government buildings and the maintenance and repair of state buildings, and considered that a municipality with a good engineering staff would be quite willing to accept this extra work. The engineering staff employed by municipalities was generally speaking not as good as that employed by district boards, but certain municipalities such as the Gaya Municipality, had in their employ engineers who had served as temporary engineers in the Public Works Department.

3,603. (Sir Noel Kershaw.) He believed that Superintending Engineers when acting as Inspectors of Local Works communicated instructions direct to district engineers on technical points and there was no objection to a continuance of this practice. The terms as to the percentage that should be paid to each board for the execution of government work should be regulated with reference to the status of each district and the extent of work which could be entrusted to each individual board. The establishment charges would then vary according to the capacity of each district board, and to the nature and importance of the work entrusted to each. Separate arrangements with each board would be more economical than concluding terms with various classes of district boards, as it was very difficult to classify the work which it was proposed to transfer to the boards. Any such classification if attempted would, in his opinion, be more or less arbitrary. If buildings were scattered in the area controlled by a particular board their cost would be greater than if they were in a compact area. Hence it would be almost impossible, in certain instances, to fix a general scale by which to regulate the establishment charges to be paid to the several district boards.

3,604. (Mr. Mackenzie.) He advocated that government work might be transferred in the manner he had suggested even if non-official chairmen were appointed to district boards, as such chairmen would in all probability be alive to their responsibility. Any responsible district board, in his opinion, would certainly take as much interest in work that was entrusted to its care by government as it took in its own work.

3,605. (Rai Bahadur Ganga Ram.) The public opinion of the inferiority of the architectural properties of the buildings in the New Capital at Bankipore was the outcome of an outward inspection of those buildings only. His remark that cracks had been found in some of the buildings connected with the High Court did not apply only to that portion of the superstructure which had failed, because he believed that cracks were still observable in some of the buildings.

3,606. He had erected a building of his own and utilized the services of a professional man for its construction to the extent that this individual had supervised the work of the labour contractors he had engaged.

3,607. He did not think that the Inspectors of local works submitted annual inspection reports to district boards but such officers made criticisms which were of a more or less technical nature when they conducted inspections.

3,608. (Mr. Cobb.) The members of each district engineer's staff were appointed by the district board on the recommendation of the engineer, and the system had hitherto worked satisfactorily. It would only be in cases where works were situated in separate localities that district boards would require to augment their staffs on accepting government work, and wherever district board and government works were in the same locality the present district board staff would suffice for both.

3,609. Members of districts boards as a rule had a high regard for the opinions expressed by their district engineers, and he knew of no case where a board had selected as a member of their engineering staff an individual other than the one recommended by the district engineer.

3,610. (Mr. Bremner.) The period between the date of sanction to a district board work and that on which a contract was entered by the board depended on the

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nature of the work. In the case of small works it was possible for such period to extend to only six weeks or two months, but if a work which involved a large sum of money was under consideration, the period was usually considerably longer.

E. BLABER, Esq., Superintending Engineer, Public Works Department.

Written Statement.

3,612. (I.) Economy and suitability of methods of execution of public works.—Under the present system civil works, original and repairs, are carried out by the Public Works Department, (in some cases by the district board who receive 15 per cent. on the estimated cost of works.) The Public Works Department prepares the plans and estimates, supervises the work and, in addition, practically does all the work done by the builder in England excepting the supply of labour and some of the materials. Exceptions must be made in the case of very large concentrated works, taken up by contracting firms of recognised standing, where a smaller amount of supervision and direction of labour is required from the Public Works Department. But by far the larger part of general civil works, especially repair work, is done by petty contractors, men of little or no building or engineering knowledge, but who have a command of labour. These men supply the labour and some of the materials and the Public Works Department look after the general arrangements on the work, generally supply plant, do the setting-out, show the labour how work is to be done, keep the workmen up to their tasks, supervise the preparation of materials and the work in all stages and carry out the measuring up and preparation of bills.

(2). These replies will refer entirely to conditions outside of Calcutta as they exist in the ordinary *mofussil* towns and rural areas of this province.

(3). In my opinion the existing system is as economical and suitable as could be devised for the present.

3,613. (II.) Encouragement of other agency.—The encouragement of private enterprise to assist the development of the country is certainly desirable, but how far this is possible in the engineering and contracting line at present without seriously increasing the cost of work is open to question. My own experience is that *mofussil* contracting businesses are slowly developing and that this development should be allowed to expand naturally.

(2). Conditions in India and in England are very different. In England one has large towns everywhere, with a correspondingly large amount of private contracting and building work going on (as opposed to purely government work) the private work being largely in excess of the government work. In India the opposite is the case, as there is almost an entire absence of large towns, and the amount of private engineering and contracting and building work going on is very small as compared with the government building works, so that at present the field for contracting business outside government work is not large. Take, for example, Patna City, Bankipore and Dinapore which taken together will, I think, give the largest collective community to be found in the province. We may take it that here the total works, original and repairs, done by the Public Works Department plus that done by the district board and municipality during a year stands at an average of, say, 8 lakhs of rupees—approximately 5 lakhs for Public Works Department works and half-a-lakh each for district board and municipality. To this may be added at the outside one lakh for private works making seven lakhs altogether. This five lakhs value of government work in the year includes profits amounting to about Rs. 37,000. This would be divided between perhaps 70 or more contractors. These may be divided into;

- (a) large contracting firms;
- (b) middle class contractors; and
- (c) petty contractors.

The large contracting firms of Calcutta will not as a rule take up any *mofussil* work under, say, 2 to 4 lakhs of rupees concentrated in one place; such large works are

3,611. The district engineer occasionally, particularly in the case of repairs to buildings, sanctioned the commencement of work on his own responsibility and before it had been discussed by the board.

infrequent. So that the *mofussil* work, with the exception of the few very large works, falls to the middle class contractor and to the petty contractor. Of these above-noted contractors about 90 to 95 per cent. will be petty contractors, who are satisfied with profits of about Rs. 60 a month, and the balance will be middle class contractors, who look for profits on a larger scale.

(3). In any scheme of building through contracting agencies, instead of by the Public Works Department, the petty contractors would in all likelihood fall out from contracting business for government and would take up sub-contracts under the larger firms. The larger firms getting more work would find it increasingly difficult to get more local labour and would probably have to sub-contract to these petty contractors, who have command over local labour. This would mean the introduction of another middleman and consequent increase in the cost of work equivalent to, say, 5 per cent. increase on the profits.

(4). There then is to be considered the question of supervision, and here emphasis is laid on the almost total lack of real skilled labour. I consider that the poor quality of skilled labour is one of the most serious drawbacks to development of the country; and the outstanding feature of so-called skilled labour in this country is dilatoriness, carelessness, inaccuracy and a total lack of pride in the work or any ambition to improve. There are exceptions of course but that is the general condition of so-called skilled labour. This means that if work of even a medium standard is to be obtained, a large supervising staff is needed, men who practically show the workmen how to do their work and keep them up to the standard from which they immediately fall away when not supervised. Unskilled labour in the same way has to be constantly directed and guided. These are the duties which (with the exception of the large contracting firms, who only take up very large projects in the *mofussil*) are now undertaken by the Public Works Department. If the Public Works agency is withdrawn this expenditure on supervising staff will have to be borne by the contractor, or alternately if he does not employ it, the standard of the work will deteriorate accordingly, and the cost will rise and the result is likely to be the reverse of economy.

(5). I will here give some figures of cost of establishment as taken from the divisions in this circle of superintendence. Taking the Patna Division which is a concentrated compact charge practically confined to Patna, Bankipur and Dinapur towns we find that for the three years 1913-14, 1914-15, 1915-16, the average cost of all Public Works Department establishment from the Executive Engineer and divisional office downwards (omitting share of Superintending Engineer's, Chief Engineer's and Accountant-General's office) works out at just 4.95 per cent. on the total cost of work done, the total cost of works executed in the three years being Rs. 26,01,448 and the cost of establishment and contingencies in the same period being Rs. 1,28,706. This is a very reasonable charge. In the Special Works Division, from the commencement of the capital works up to the end of 1915-16, the total expenditure on works is Rs. 57,77,528 and the cost of establishment (again omitting share of establishment of Superintending Engineer's, Chief Engineer's and Accountant-General's office) was Rs. 2,01,800, which gives a percentage of 3.49. In the case of these special works, however, one-half of the work (or Rs. 28,88,763) has been done by a Calcutta firm to whom a payment of 5 per cent. on works done by them has been paid to cover their establishment charges. So that taking into consideration this 5 per cent. on Rs. 28,88,763 paid to this firm, the total cost of establishment comes to Rs. 2,01,800 and Rs. 1,44,438

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which works out to a percentage of 6 per cent. on the cost of the work done. The case of these two divisions is instructive. We here have the Patna Division and the Special Works Division working alongside of one another in the same town, the Patna Division employs chiefly petty contractors with occasionally larger contracting firms for the largest works, whilst the Special Works Division employs a large Calcutta firm for 50 per cent. of the work paying them 5 per cent. for establishment charges, partly with a view to reducing the Public Works Department establishment; but we find the percentage of cost of establishment in the Patna Division to be 4.95 per cent. as against 6 per cent. in the case of the Special Works Division. The standard of work done, however, in the Special Works Division is distinctly higher than that done in the Patna Division, there being a larger proportion of Assistant Engineers and upper subordinates employed in the Special Works Division, and this large contracting Calcutta firm itself employs a good supervising staff. This bears out my statement above that a reduction of supervision below what experience shows to be necessary is followed by a falling off in the standard of work.

(6). The third division comprised within this circle of superintendence is the Bhagalpur Division; this is quite unlike the other two divisions and forms a very scattered charge over a large rural area covering the whole of the four districts of the Bhagalpur Commissioner's division (viz. the districts of Bhagalpur, Monghyr, Purnea and Santal Parganas); large tracts of this country are subject to prolonged and severe floods which cut communications and render travelling and the transport of material impossible at times. The supervising staff has to spend much of its time in getting from place to place, whilst it is frequently difficult to get any contractors to take up work, owing to labour difficulties, bad communications and climatic conditions. In this division during the three years 1913-14, 1914-15 and 1915-16, the total numbers of separate works taken up in this division (both original and repair) amounted to 2,943 at a total cost of Rs. 17,01,485, and some 80 different petty contractors were employed; the average number of separate works taken up each year were therefore 981. The total cost of establishment for these three years was Rs. 1,98,829, which gives a percentage of 11.68 per cent. Considering the widely scattered nature of these works and the difficulties of communications, this percentage cost of establishment is not high; whether this could be reduced by transferring the works of this division to the four different district boards is very doubtful and I discuss that later. It is, however, in my opinion quite out of the question to consider the employment of private agency under these conditions. The percentage cost of establishment for the three divisions in this circle are therefore 4.95 per cent., 6 per cent. and 11.68 per cent. respectively on the figures of the last three years.

(7). One further point which is to be taken into consideration is that of the supply of materials. The present practice is economical whereby such materials as steel and iron-work, cement, house fittings, etc. are purchased direct by the Public Works Department from the most suitable markets and issued to the contractor. If the contracting agency is employed, the contractors will assuredly claim that they be allowed to supply all such materials and charge their profit on them. This would mean a further addition to the cost of work. Again assuming that work is being done through a contracting agency, and that on behalf of government the work is watched by an Inspector or a clerk of works or whatever he may be called. The works to be dealt with are made up mostly of a large number of minor works with a few major works scattered over a considerable area. Unless a large number of such Inspectors or clerks of work were employed, (and it would have to be on good salaries) work would seldom be inspected. Take the case of the Bhagalpur Division with its 981 separate works scattered over four districts. All works should be inspected once a week on the average; assuming three quarters of these works to be going on simultaneously in the year, this would give 103 works to be inspected daily; owing to their being

so scattered the average number of works an Inspector could visit daily would probably not exceed five, this would entail the employment of 21 Inspectors for this division. As regards the frequency of inspections, a small initial error in reading the plans, or in the material, or workmanship if not detected may, at the end of a week, be a matter of considerable expense to rectify, and under existing conditions contractors rely on the constant and practically daily supervision of the Public Works Department staff to set these defects right and these are nearly always brought to their notice promptly. If the Public Works Department supervising staff is removed, contractors will have to take full responsibility for such errors. It is of course only right that they should do so, but the contractors are bound to take this as an added risk under the proposed conditions and will increase their rates accordingly. With the class of contracting firms who take up, or are likely to take up, the *mofussil* work there would be, I am afraid, a tendency towards lengthy claims leading to arbitration or law suits, which will all again tend to more expensive work. For work to be done through the contracting agency it is essential that the firm be sufficiently financed and of good repute and that it maintains a well paid and efficient staff. This matter is an expensive item in a business. It is one thing where a comparatively large block of work may be taken up in one concentrated locality. It is then possible to keep a well paid and efficient staff, but to have work scattered at long distances over large areas in a district in this country, where the means of communication are difficult, is quite another thing, and no good firm would look at such work except at exorbitant rates. I think that government work through contracting agencies in the rural areas is quite out of the question and unworkable and that even in a *mofussil* town such as Patna and Bankipore it would prove highly expensive and that in smaller towns throughout the province it would be as unworkable as in the purely rural areas. There would not be sufficient work to keep a sufficient number of really sound contracting firms employed, in order to obtain healthy competition.

(8). I would add one more point here. This is with regard to tools and plant. Under existing conditions, the Public Works Department as a rule give expensive plant to contractors on loan for works. This includes such plant as mortar and *sarkhi* mills, portable engines, centrifugal pumps, pulsometers, road-rollers, both hand and steam. This is an economical arrangement. This plant is transferable from one Public Works division to another to meet the calls of work in different places and is, when required, lent to district boards. None except very large firms of contractors could afford to invest in sufficient expensive plant to meet all requirements as they arose. I consider that the present method of execution of civil works by the Public Works Department, so far as this province is concerned, is, on the whole, the most economical that can be devised and eminently suitable at any rate for many years to come.

(9). The first difficulty to surmount is that of skilled labour, which is a question I believe that is being considered by the Royal Industrial Commission. By the employment of petty contractors one gets both labour and materials at the cheapest rates and the system is particularly suited to the rural areas.

(10). Next as regards, the execution of government work through the agency of district boards. There is no doubt at present, in some cases, a certain amount of overlapping of the areas in which works are being executed both by the Public Works Department and the district boards where the work might reasonably be done by the latter in place of the former. I have specially in mind the Bhagalpur Commissioner's division which consists of the districts of:—

Bhagalpur,
Monghyr,
Purnea, and

Santal Parganas as already noted.

Each of these districts has its own district engineer and in addition there is a Public Works Executive Engineer

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with the headquarters at Bhagalpur who has charge of all Public Works Department works in these 4 districts. I have gone into the possible advantages of this case, which is rather a special one, of transferring the Public Works Department works from the Executive Engineer, Bhagalpur, to the four district engineers of the Bhagalpur, Monghyr, Purnea and Santal Parganas districts. A statement is attached herewith showing the average annual expenditure on establishment of the Bhagalpur Division during the past three years, together with an estimate of the additional expenditure such a transfer would throw on to the district boards. This statement is prepared on the assumption that the Public Works system of accounts would be continued and that the district engineers would receive no additional superior engineering establishment to assist them with their considerably increased work. This latter assumption I am not prepared to endorse, for I consider that district engineers of the larger districts have already got their hands full and that the first result of giving them all the Public Works Department works in their respective districts would be the need of giving some of them added help in the way of an assistant district engineer, and the resulting economy would largely vanish.

(11). It is also probable that this sub-division of account-keeping from one central office to the four separate offices of the district engineers will increase the work in the Accountant-General's office.

(12). My experience of work both under this Department and the district boards leads me to say that by transferring work to the latter the standard of work is likely to be a lower one.

(13). The procedure under which work is at present carried out for the government by the district boards in a few cases is that government gives the district board concerned 15 per cent. on the cost of the work to cover additional establishment and tools and plant. Out of this the district engineer usually draws 5 per cent. Under such an arrangement government still allots funds for and retains control over the expenditure on government work whilst the execution of it is carried out through the agency of the district board.

(14). The general control and supervision of the work is maintained for government by the Inspector of local works who is in most cases the Superintending Engineer in the Public Works Department. A change as outlined above would not effect any saving in the establishment of the Superintending Engineer's, Chief Engineer's or Accountant-General's office, if anything it would be the reverse as we should have to deal with four offices instead of one. As shown above it costs government 12.5 in establishment to run the Bhagalpur Division, Public Works Department office, to which may be added 1.5 per cent. for tools and plant making 14 per cent. in all. Unless the proposed change will effect a real saving to government there is no object in making it. Suppose district boards were willing to take this additional work at a remuneration of, say, 10 per cent. on cost of work to cover both establishment and tools and plant in place of 15 per cent. now paid, govern-

ment would then effect a certain saving in establishment and tools and plant, about Rs. 22,000 a year on the basis of the figures for the past three years. Under such an arrangement the practice of giving the district engineer 5 per cent. on the cost of all government work as his personal remuneration would have to cease, and rightly so as this remuneration is very high: it might be that in any one year a district board would execute perhaps works to the value of Rs. 2½ lakhs for government in which case the district engineer's personal remuneration would amount to Rs. 12,500 or over Rs. 1,000 a month over and above his pay. District engineers' emoluments should not be subject to fluctuation of this kind; their pay should be brought into line with that of Executive Engineers in the Public Works Department and they should have the benefit of a provident fund on the lines of that existing in the East Indian Railway; this latter is, however, at present more than the financial condition of district boards will allow. District engineers should also be entirely debarred from taking up private practice, this should be left for the private practitioner.

(15). Summing up on this question then, my opinion is that the execution of government work by private engineering and contracting firms is now and for many years to come even in the larger *mofussil* towns and all rural areas quite unworkable. Also that it is too early yet to hand over government buildings and works to district boards entirely free from government control. But that a step in this direction might be made in selected cases by utilizing to a larger extent the agency of district boards for executing work for government, though I do not consider this will effect any appreciable economy, if any at all.

3,614. (III.) Changes in organization.—I consider it is desirable to continue for the present the recruitment of Public Works Department engineers on the existing system. My experience of this system has been that it has given us on the whole a good type of young engineer, the public school boy with a sound engineering education. The proportion thus recruited is not large; these young men enter on their duties out here with a keenness and self-reliance that is a great asset in the training of those under them.

3,615. (IV.) Relations with other departments and sub-branches.—The relation between all concerned I have always found satisfactory and I have nothing to suggest as to increased economy or facility of execution.

3,616. (V.) Decentralization.—I am not prepared to suggest any further decentralization within the Department at present.

3,617. (VI.) Simplification of procedure.—I do not consider that the Public Works Department Code rules are unduly restrictive.

3,618. (VII.) Education.—This is a question in which those directly connected with the colleges can best give an opinion. My own experience is chiefly limited to the men we get from the Sibpur Engineering College. We get men occasionally who, as far as education in engineering subjects go, are capable of developing into fully qualified-engineers if they get the necessary

Superior engineering establishment.	Subordinate engineering establishment.	Office establishment, general and accounts.	Travelling allowances, superior engineer establishment.	Travelling allowances, subordinate engineering establishment and contingencies.	Total.	REMARKS.
1	2	3	4	5	6	7
Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
14,718	17,122	18,332	4,000	11,438	66,276	Bhagalpur Division, the average expenditure on establishment for 3 years, 1913-14, 1914-15 and 1915-16.
..	12,720	21,120	..	8,000	41,840	Anticipated expenditure if works made over to the four districts.
-14,718	-4,402	2,768	-4,000	-3,438	-24,436	The total saving on establishment being say, Rs. 25,000 per year.

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experience; but these are men who when they leave college do not imagine themselves to be ready made engineers, as too many do, but continue to study engineering subjects and to improve their knowledge in directions both theoretical and practical. If men of this type combine with the above strength of character, firmness or what may be called "back-bone", capability of forming a sound judgment which is most essential in engineering, I see no reason why the engineering colleges should not produce men capable of becoming thoroughly qualified engineers.

(2). As regards architectural education, I am not aware to what extent this is taught in the Indian engineering colleges. An architect cannot be manufactured. Up to a certain point engineer and architect students might follow the same course of education, during which time it would be possible to ascertain whether the student has or has not the makings of an architect in him. If he has not, it would be little use for him to take this up as a profession. If he has, on the other hand, he should then pass on to more specialized education in architecture.

(3). As regards the lower subordinate or sub-overseer class, there is much room for improvement. We occasionally get sub-overseers who do very well but this is not a rule. The lines on which an improvement should be effected are, I consider, in the first place to improve the pay of these subordinates, and secondly, which I think is the more important point, to improve their prospects. Sub-overseers who in the first ten years of their service or so have proved themselves worthy of it, should be able to obtain promotion to the overseer class. I consider such men, as a rule, with their acquired experience, are far more satisfactory and useful to their employers than the overseers who pass into this class straight from college. We do not require men in the upper or lower subordinate grades to have advanced theoretical training. What we want are men with a knowledge of surveying, a certain amount of chemistry, geology, drawing, engineering, etc., but in especial, a thorough knowledge of practical building work. Every subordinate ought to be able to explain to the carpenter, the mason, the painter, the blacksmith or the fitter how his work should be done. This is particularly necessary in a country like this, where the skilled labour is so inferior and unreliable. This should form an important part of their education. These last remarks apply equally to the overseer class, a class which I should recruit more largely by promotion from the sub-overseer class instead of by direct appointments. I would at the same time slightly improve the pay of the overseer.

3,619. (VIII.) Practical training.—On this point I consider that government should give facilities for Indians who have received their engineering education in recognized English or Indian colleges for acquiring practical knowledge on works undertaken by government.

This privilege should be a valuable one to engineering students straight from college but how far it would be taken advantage of is doubtful. I consider that this privilege should be made as wide as possible, subject to suitable rules being framed to which all such students would be required to conform, or else the privilege would be withdrawn. Applications should be made to the Secretary to the local Government in the Public Works Department stating in what branch of engineering the student requires experience—whether buildings, road making, bridge work, sanitary work, or electrical work, etc., and he would then be allotted to the work to which he could be attached.

3,620. (General.) This completes my replies to the questions but I would add the following suggestions on the subject of economy. I consider that increased economy in public works would follow if valuable knowledge and experience gained in different works could be more widely diffused. At present an engineer working in one district knows little of the work going on in the next district to him. You may frequently find men needlessly spending money in solving a difficulty which has already been solved before, but the information is buried in some Executive Engineer's office of no use to anyone else. Executive Engineers in any one Superintending Engineer's circle are not so likely to remain ignorant of the work of the other Executive Engineer in the same circle, but it would be so in the case of two separate Superintending Engineer's circles. It is more particularly so in the case of district engineers; they remain for years in one district and are apt, I think, to get very much into grooves, and to lack the opportunity of getting fresh ideas and exchanging ideas with other engineers.

(2). I would suggest that government should require in the case of all works of an engineering character that are out of the usual run or in any way deal with special difficulties or new ideas, that a short report with dimensioned plans should be submitted to the Chief Engineer. These would then be printed and an index maintained which would be supplied to all Superintending Engineers and Executive Engineers so that when similar difficulties arise the benefit of previous experience may be forthcoming to save expensive experimenting again on a question that has already been solved. In addition I consider much greater facilities should be given to engineers to visit other works on duty; this would broaden their ideas and would in every way tend to raise the level of engineering practice and tend towards economy. The two Simla conferences held in the last ten years have, I am sure, been most fruitful in diffusing much very useful information between the different provinces. Such conferences are, of course, expensive to arrange for and carry out, but I should like to see much more on the same lines but on a smaller scale such as provincial or even smaller conferences.

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3,621. (President.) The witness stated that he was a Superintending Engineer of the Public Works Department and that he had had 22½ years' service, the whole of which had been spent in Bengal and Bihar and Orissa. He had for the past 5 years been attached to the Buildings and Roads Branch previous to which he had served entirely in the Irrigation Branch.

3,622. Tenders were invited in his circle for all works, with the exception of petty works, and notices in this connection were posted up in the offices of the Superintending and Executive Engineers. Advertisements calling for tenders were occasionally inserted in the newspapers, but there was no general rule in the matter and it was left to the discretion of the Executive Engineer. Contractors were also occasionally informed by letter that a certain work was open to tender, but public notices were always posted up whether this had or had not been done. There had been cases in which notices had not reached contractors and, to obviate such a contingency

in future, tenders might be advertised through the agency of "Indian Engineering" or other papers. He agreed that it was expedient that all contracts in excess of a certain limit should be advertised in order to ensure publicity.

3,623. The system of giving out lump sum contracts was not in vogue in the province as it had been abandoned in Bengal many years ago for reasons unknown to him; he had had no experience of such contracts. The two forms of contract generally in use in the province were (1) the piece-work agreement, in which the contractor agreed to supply or carry out certain kinds of work at particular rates; and (2) the regular contract, in forms K-I and H which were more or less similar. The latter form was used for the larger contracts and the former for isolated contracts for which, as a rule, the contractor quoted his rates. A time limit was usually enforced for large contracts at the discretion of the Executive Engineer, but it was not always necessary to specify a penalty in the case of contractors who were

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well known to the Department. In his opinion, the existing system afforded reasonable encouragement to private enterprise.

3,624. Contracts were generally not split up, and were given out by entire works, except in cases where there were different classes of work, e.g., plumbing and electrical work. An entire contract given out for a whole work did not necessarily include the supply of bricks, as petty contractors preferred that the Department should supply such material owing to their not having sufficient capital for its purchase or manufacture. There were a large number of petty contractors in Bankipore, but only a few of them manufactured bricks. The Department as a matter of fact preferred to give out contracts to men who were able to supply their own bricks, but where such were not available they were obliged to purchase and supply bricks to contractors.

3,625. Cement was invariably supplied to contractors by the Department in order to ensure its quality. The brand of cement used at present was chiefly *Katni* because British cement was rather expensive; a further advantage gained in the supply of cement by the Department was that the material was always fresh, whereas if its supply were entrusted to contractors there was a likelihood of the supply being stale, deteriorated or adulterated. Large contractors supplied their own cement, but the Department preferred to issue its own cement to small contractors.

3,626. He was not in favour of entrusting all the works within a specified area to one contractor. The larger contractors who had been employed for the construction of works in Bankipore had not sub-let their works to any extent. But on the other side of the river such was the case, two large firms employed there in connection with the construction of irrigation works having sub-let much of their masonry work and earth-work.

3,627. The standard of bricklaying and plastering work in the province was rather low, but as his experience of such work was confined to Bengal and Bihar and Orissa he could not compare it with the standard of such work in other parts of India. The carpenters obtainable in the province were not of a high order. He had had very little experience of Punjabi carpenters, but considered the Chinese carpenters were very much above the ordinary standard. The introduction of a system under which English master craftsmen, such as bricklayers, plasterers, etc., would be recruited for the province in order to set up a higher standard of work than at present prevailed, would only be successful if the system was of a semi-permanent nature; otherwise, no benefit would accrue from its introduction as the Indian, as soon as he was left to his own resources, would revert to his own methods of work.

3,628. He could not assign any reasons why the charge of a Superintending Engineer in the province was much smaller in area and as regards expenditure than in other parts of India, unless it was due to the Superintending Engineer being also the Inspector of local works and to the rates for work being higher elsewhere, as in Assam. The Gandak irrigation circle was small and consisted of only two divisions. It was too far away to be linked up with another irrigation circle. The average charge of a Superintending Engineer in the province consisted of just over three divisions per circle, whereas the average throughout India was between five and six divisions per circle; the combination of the Gandak circle with another would of course, if feasible, reduce the present disparity. The circles in the province were possibly more scattered and isolated than in other provinces. In the Buildings and Roads Branch two circles were certainly necessary as long as the New Capital works were in progress; thereafter it might be possible to reduce these to one circle only on the assumption that the Superintending Engineer was relieved of the duties of Inspector of local works, and if a proportion of Public Works Department work were handed over to the district boards and further if it were possible to place the Sambalpur Division in the Orissa circle.

3,629. The direction charges in Bihar and Orissa amounted to 45 per cent. of the total establishment charges whereas the average of such charges for India was about 25 per cent., and seemed extraordinarily heavy. It was quite possible that the charges would be reduced when conditions in the province had become more settled but he had not gone into the question.

3,630. He was not able to state why the expenditure on the Executive Engineer establishment was very small compared with that of such officers in other parts of India, but surmised that it might be on account of the number of provincial engineers.

3,631. Although sub-divisional officers in the province seemed to perform half the work and to incur half the total expenditure as compared with other provinces, any doubling up would result in a decrease of supervision. Sub-divisional officers in charge of headquarters sub-divisions did not make payments, as disbursements could in such cases with advantage be made by the divisional office. Sub-divisional officers in the Bhagalpur Division, which comprised four districts each under the charge of a sub-divisional officer, were however allowed to make payments by reason of the distance of their sub-divisions from the divisional office and the arrangement was satisfactory.

3,632. He was opposed to the abolition of Superintending Engineers by the delegation of increased powers to Executive Engineers, as he considered Executive Engineers, and particularly junior officers, relied a great deal on the Superintending Engineer for advice and assistance. The Superintending Engineer, moreover, could guide and direct Executive Engineers by reason of his greater experience and was more than paid for his appointment by the help and advice he gave to Executive Engineers, who in turn were thus able to develop their ideas and gain experience. Besides, if there was no connecting link between the Chief Engineer and Executive Engineers the former would not retain the touch which he did at present with the latter officers. He was emphatically opposed to the view that the Superintending Engineer's office was largely a post-office and that that officer was an extra cog in the wheel of procedure.

3,633. He did not agree that the inspection of works by the Superintending Engineer was of no utility, as his experience had been that such inspections were of great value and resulted in considerable economies and improvements in works under construction.

3,634. In connection with the execution of government works through the agency of the four district boards in the Bhagalpur Division, he explained that the figures showing the anticipated expenditure in line 2 of the statement in his written evidence were drawn up in consultation with the four district engineers concerned and that the estimate was based on the assumption that the accounts and office procedure of the Public Works Department would be maintained as it was at present. No allowance was made in his estimate for remuneration to the district engineer for the construction of government works, as he considered that such officer on principle should not be allowed any additional remuneration in this connection but should have an improved scale of pay in such cases. He was aware of only one small district in which the district board had constructed government work, and stated that it was not generally possible to compare the cost of works constructed by district boards with that of works executed by the Public Works Department as the latter observed a more or less uniform standard whereas the works of the former varied according to the personality of the district engineer. The specifications of district boards for certain classes of work did not always tally with those of the Public Works Department. When he was first appointed Inspector of Works about 5 years previously he had had the opportunity of seeing the specifications of district boards and found that in some cases practically none existed and that those which were in use were sketchy. He had compared some rates taken from the schedule of rates in use in the four districts in the Bhagalpur Division with those of the Public Works Department and had found there was very little difference between the two. Works

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in his circle were as a rule constructed on the schedule of rates and he was opposed to the acceptance of tenders below the scheduled rates.

3,635. In addition to his duties as Superintending Engineer he performed those of Inspector of Works and personally evinced a keen interest in district board works. The Inspector of Works in the Bhagalpur Division had found it very difficult to inspect district board works as most of his time had been absorbed on the construction of the New Capital at Bankipore. The inspection of district board works by the Superintending Engineer was most useful if it was conducted in the proper manner and the chairmen of the boards appreciated it very much; it undoubtedly led to a higher standard of building and effected considerable economies. The approval of the Superintending Engineer to district board plans and estimates was useful and necessary. District boards could sanction the construction of buildings according to their classes, e.g., a first-class district could sanction estimates up to Rs. 10,000 and a second-class district estimates not in excess of Rs. 2,500. He was not in favour of an increase in these limits.

3,636. His powers of technical sanction were Rs. 50,000 and those of Executive Engineers Rs. 5,000. In his written evidence he had stated that 'he was not prepared to suggest any further decentralization within the Department at present' but he modified this opinion to the extent that he recommended an increase in the powers of technical sanction of Executive Engineers to Rs. 10,000.

3,637. Superintending Engineers' limited powers of punishment or dismissal in the case of subordinates were not conducive to efficient work. He therefore recommended that Superintending Engineers should be empowered to dismiss upper subordinates after due inquiry had been made into their cases, subject to an appeal to the Chief Engineer, and that Executive Engineers, similarly, should be empowered to dismiss lower subordinates subject to an appeal to the Superintending Engineer.

3,638. Lower subordinates were given more theoretical training than they required for the satisfactory performance of their duties. He was opposed to the suggestion that the lower subordinate staff of the Buildings and Roads Branch might be divided up into two sections, one composed of estimators who had received a theoretical training and were conversant with English, and the other of practical *mistris* who would be placed in charge of the actual construction of works as he preferred to retain the present type of lower subordinate and give him a practical training.

3,639. Executive Engineers were considerably overburdened with accounts work, but the witness did not think such work could be divorced from the office of the Executive Engineer as the accounts and executive work were closely intermingled. When he was in executive charge his accounts work had averaged about two or three hours a day throughout the month, and the monthly accounts had consisted of about 100 forms on each of which he had had to sign his name once. He had sometimes to sign his name more often so that altogether the signatures amounted to between 100 and 200. No considerable help would be afforded to the Executive Engineer if he were merely relieved of the compilation of his accounts work, as the compilation of accounts was undertaken by the accountant and did not absorb much of an Executive Engineer's time. He preferred not to express an opinion on the proposals (1) that from an executive point of view all that was required to be kept in the office of the Executive Engineer was a register of works which would show just sufficient detail to judge how work was progressing, and (2) that just sufficient detail should be kept to work out the actual rates of construction of important sub-heads, thereby rendering useless all other accounts work which could be abolished so far as the Executive Engineer was concerned.

3,640. No provincial engineering conference had been held in the province owing to the lack of organization; there had been no other obstacle in the way. Such conferences would very largely meet the object he had

in view, namely, the diffusion of useful information connected with engineering matters between the several provinces.

3,641. (Mr. Cobb.) The present class of Executive Engineers was not as good as that obtained formerly. Some of the Executive Engineers were not suited to an engineering profession, and possibly insufficient selection had been exercised in the promotion of such officers which was regulated more with reference to their age or seniority. Senior officers besides were inclined to be a little too lenient in the promotion of Assistant Engineers to executive rank in that they did not like to stand in their way and this, of course, was not a good principle. As a result of this procedure the present class of Executive Engineers contained some inefficient officers.

3,642. Repairs could not be carried out without estimates as contractors would not know what materials to collect for the purpose. The estimate was a guide to contractors as to what materials they were required to collect beforehand, and without it they would have to wait till the sub-overseers informed them what materials were needed and this procedure would result in a waste of time. He did not think that a good many repairs which were not actually needed had been carried out simply because there had been sufficient money set aside for the purpose, as strict control was exercised over expenditure.

3,643. He had no suggestions to offer which would obviate the procedure under which plans and estimates were called for from the Public Works Department for schemes which never materialized, owing to the insufficiency of funds, but remarked that this was to a great extent guarded against by the Bengal Government Resolution No. 1533—1630, dated the 12th April 1911, (paragraph 8.)

3,644. (Rai Bahadur Ganga Ram.) His statement that 'the present day Executive Engineer was not as good as had formerly been the case' applied more to Indians, because of their lack of general administrative control over the staff employed under them, than to Europeans who were as good as those employed formerly. He had given due consideration to the matter both from his buildings and roads and irrigation experience in making the statement, but was unable to say whether the fault was due to the system of recruitment at Roorkee as he had had no experience of that college, his experience in this direction having been almost entirely confined to Sibpur.

3,645. The construction of work by the Sanitary Engineer with a specially trained staff was probably economical. But as the system had been in force only for about six months he was not in a position to say whether if such work were handed over to the ordinary Public Works Department staff for execution, a saving would be effected thereby.

3,646. The ordinary Public Works Department staff would be capable of undertaking the construction of buildings designed by the Government Architect provided that officer frequently inspected the works, as there was a large amount of detail, in which the Architect's advice was needed. The adoption of such a system would not lead to a large increase in the cost of the Public Works Department establishment, as the Architect would not be required to inspect every building.

3,647. He had not had experience of a man of the craftsman class having risen to the rank of upper or lower subordinate.

3,648. He had had occasion to indent for stores on the Secretary of State and was cognisant that a certificate had to be signed when submitting indents certifying that the necessary stores were not available in India.

3,649. *Katni* cement was at present being used by the Department and *Arbuthnot* cement had been tried some years previously.

3,650. (Sir Noel Kershaw.) His remark that Executive Engineers needed the assistance and advice of the Superintending Engineer applied mainly to the younger officers, that is, to those who had recently been promoted to executive rank.

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3,651. There was no necessity for the use of first-class bricks in partition walls as well as in exterior walls, and it would be more economical to use second-class bricks in the construction of works. Such a practice would not result in any danger as regards structural stability.

3,652. Petty contractors, or middlemen, preferred having subordinates to supervise their works because, if anything went wrong, the subordinate was able to point out the defect. If a large contractor employed his own supervising staff on the construction of a building, the presence of subordinates of the Public Works Department would not necessarily imply that the contractor would be put to more expense.

3,653. The question of the burdening of superior officers of the Department with petty routine accounts and office work was one which required careful examination, but it was very difficult to cut the Executive Engineer adrift from his accounts and office work with which he was so much concerned. The Department had been endeavouring as far as possible to pay contractors monthly to deter them from borrowing money for the construction of their work, but the preparation of a detailed bill was necessary before payments could be made. He therefore advocated that payments should be made on an estimate of work done within a certain period without resort to actual measurements, and that a commencement should be made in this direction with the Executive Engineers, and that if the system proved satisfactory that it might be extended to sub-divisional officers. The adoption of the system he had proposed would save much labour on the part of both the Executive Engineer and sub-divisional officer and at the same time effect a certain amount of economy in staff.

3,654. (*Mr. Bremner.*) It was a fact that, prior to the separation of the province from Bengal, expenditure on works was largely concentrated round Calcutta, and

that Bihar and Orissa did not receive its average share of money for building work. Moreover, no detailed estimates were ready when the province had been separated as no money had been allotted in the budget for building work, so that the first year before the outbreak of war was chiefly taken up in the preparation of projects and not in the construction of large works. In fact no large works, except in the vicinity of Bankipore and Ranchi, had yet been commenced. There was a certain amount of bridge and road work which had not proceeded any further as, owing to the outbreak of war, expenditure thereon had mostly been at a standstill.

3,655. There was a large amount of embankment and tidal river inspection work in the Orissa circle, but since the formation of the province practically no original irrigation work had been carried out, the work having been confined almost entirely to maintenance. Hence, owing to the fact that a large establishment had to be kept in irrigation divisions for maintenance and the assessment of water rates, the proportion of establishment to works in irrigation divisions was extremely high.

3,656. Until quite recently there had been only three circles in the province, the Sone circle, the Western circle and the Orissa circle. The Sone circle had been found a few years previously to be too large a charge for one Superintending Engineer and this had led to the creation of the Gandak circle. The Eastern circle was formed four years previously after the Tribeni Canal had been built.

3,657. The estimate in his written evidence in connection with the cost of maintenance of public buildings by district boards did not provide for any additional assistance to the district engineer either in the form of extra pay or of a percentage.

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MR. P. H. TILLARD.

At Allahabad, Thursday, 29th March 1917.

PRESENT:

F. G. SLY, Esq., C.S.I., L.C.S. (President).

SIR NOEL KERSHAW, R.C.B.

C. S. COBB, Esq., M.V.O.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member—

The HON'BLE MR. H. M. WILLMOTT, F.C.I., A.M.L.C.I., Chief Engineer and Secretary to the Government of the United Provinces, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary).

P. H. TILLARD, Esq., Superintending Engineer, Public Works Department.

Written Statement.

3,658. (I.) Economy and suitability of methods of execution of public works.—The present system adopted for carrying out works is both economical and suitable. A fact that bears out this statement is that nearly all large contribution works are carried out by the Public Works Department in spite of the fact that 23 per cent. is charged for establishment. If private firms or contractors are capable of carrying out work as well as, and more economically than, the Public Works Department, surely private persons would go to them, in preference to the Public Works Department. As it is, I fancy, they apply to the Public Works Department as they are sure of getting better value for their money.

(2). For example, a certain municipality entrusted a portion of their drainage scheme to private enterprise. The firm was paid Rs. 7,355 for an estimate of approximately Rs. 7 lakhs, which was beyond the means of the municipality. This was subsequently revised by the Sanitary Department to Rs. 1½ lakhs. The private engineer was paid 17 per cent. supervision charges, and there was an excess over the estimate of about 6 per cent., making in all 23 per cent. Later, when the municipality required an extension, they applied to the Public Works Department instead of private enterprise, the result was 12½ per cent. supervision charges and 5 per cent. saving on the estimate which is equivalent to 7½ per cent. The facts speak for themselves as regards economy.

(3). If reliable private firms can be found to take up building work on lump sum contract, there is no doubt that the establishment of the Public Works Department could be reduced, but I do not think that the time has yet arrived when this is possible. Further, I doubt whether it would be economical if private firms took up works. A reliable firm is not likely to take up a work at Public Works Department rates, they will require higher rates in order to cover the cost of their establishment and profit; e.g., I have been told that at Banikal, Bengal, a building was designed by the Public Works Department for the Baptist Mission, costing approximately Rs. 60,000 at schedule rates. The work was given to a Calcutta firm, who asked for Rs. 23,000 extra above the estimate or nearly 50 per cent., and they got it; if the work had been carried out by the Public Works Department the charges would only have been 23 per cent.

(4). If it is desired to reduce the establishment of the Public Works Department, I see no reason why each district should not have its own district board engineer, to carry out and supervise all local works. But if this is done, it will be necessary to have properly trained engineers on reasonable pay in the district board. By handing over local roads and buildings, the subordinate establishment of the Public Works Department could be considerably reduced.

The size of districts for Public Works Department engineers could also be increased, thus reducing the number of district engineers required, or in the event of districts being kept as they are an overseer could take charge of some of the smaller districts.

(5). As regards the economic working of the Public Works Department the following tables may be of some interest. They show:—

Column (2) actual cost of work and repairs executed by the Public Works Department,

Column (3) cost of establishment,

Column (4) percentage of establishment to expenditure for the five years preceding the war.

Table I.—Shows all works done by the Public Works Department including—

Imperial military.
" civil.
Provincial civil.
Contribution.
Excluded local.

The average percentage for establishment works out at 16.6 per cent.

Table II.—Shows provincial civil works and repairs. The average percentage for establishment works out at 20.7 per cent.

Table III.—Shows excluded local works and repairs. The establishment is a fixed sum paid by district boards and only works out at 13.3 per cent. of work done, which is 3.3 per cent. below the average of Table I, and greatly accounts for the excess on provincial works.

Table IV.—Shows contribution works. The establishment works out at the absurdly low rate of 2.1 per cent. which is probably chiefly due to many works being done free of establishment charges.

From the above remarks and tables it is obvious (I) that district boards are getting their work done cheaper than they ought to and that if the district board works are separated from the provincial works they will have to pay more for establishment in order to obtain the same supervision as they are now getting. (II) That contribution works are being done at absurdly low rates as regards establishment, and that if they were done by private firms, they would have to pay considerably more than 2.1 per cent. over and above Public Works Department rates. (III) Before it can be decided whether the Public Works Department is economical or not, it should be determined whether any private firm is ready to undertake work at a rate of 16.6 per cent. above the Public Works Department schedule of rates. Personally I do not think that a charge of 16.6 per cent. for establishment is excessive.

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[Continued,

Table I.—All works.

Year.	Actual cost of work executed.	Actual cost of establishment.	Percentage of 3 to 2.
1	2	3	4
	Rs.	Rs.	
1909-10 . . .	78,02,671	14,06,246	18.02 per cent.
1910-11 . . .	81,81,766	14,40,442	16.08 "
1911-12 . . .	89,51,004	14,12,603	15.78 "
1912-13 . . .	92,67,485	14,25,201	15.36 "
1913-14 . . .	92,33,771	15,57,723	16.87 "
	AVERAGE .		16.6 "

Table II.—Provincial.

1909-10 . . .	14,52,662	9,73,086	21.85 per cent.
1910-11 . . .	48,08,125	10,33,202	21.10 "
1911-12 . . .	49,21,677	10,26,804	20.85 "
1912-13 . . .	54,03,870	9,87,174	18.25 "
1913-14 . . .	51,11,108	10,01,881	21.12 "
	AVERAGE .		20.7 "

Table III.—Excluded local.

1909-10 . . .	25,00,877	3,56,890	14.27 per cent.
1910-11 . . .	22,77,794	3,14,690	13.81 "
1911-12 . . .	21,00,716	3,14,690	13.10 "
1912-13 . . .	23,11,785	3,14,690	13.61 "
1913-14 . . .	26,30,142	3,14,690	11.96 "
	AVERAGE .		13.3 "

Table IV.—Contribution.

1909-10 . . .	4,00,850	7,615	1.91 per cent.
1910-11 . . .	8,49,421	9,092	1.07 "
1911-12 . . .	13,37,851	9,004	.71 "
1912-13 . . .	11,39,119	39,328	3.45 "
1913-14 . . .	8,57,944	31,107	3.62 "
	AVERAGE .		2.1 "

3,650. (II.) **Encouragement of other agency.**—Private enterprise is encouraged, in so far as tenders are called for, for all buildings. There are, however, few private firms in the United Provinces capable of carrying out works without the assistance and supervision of the Public Works Department. Most of the large contractors who do work for the Public Works Department are not builders but merely suppliers of material and labour; their staff consisting generally of a few *mistris*, who are promoted artisans. I do not think that any of these contractors would be capable of preparing a design or even of taking out the quantities, when tendering for a work. They accept the estimates as prepared by the Public Works Department and, I fancy, seldom if ever take the trouble to check the quantities.

(2.) As regard rates, they tender at so much per cent. above or under the estimated rates, and have very little idea as to what the work will actually cost them. Petty and new contractors often tender at absurdly low rates in the hope of getting the work, depending on the benevolence of the Public Works Department to have their rates increased, when they find they are losing on the work.

(3.) A fact that points to there being few if no reliable firm capable of carrying out work without the assistance

of the Public Works Department is, as already stated in (1), that large contribution works are invariably carried out by the Public Works Department. An example of this is in the Benares Hindu University, where the committee in charge of the foundation stone preparations were unable to do the work and had to call in the Public Works Department at the last moment. Further a Public Works Department engineer has been lent to supervise the work of building the college; surely if private enterprise were available, it would have been employed on this work. Also the Kshatriya Hewett School, Harish Chandra High School and Tuberculin Dispensary, all in Benares, were constructed by the Public Works Department.

(1.) I am not in favour of giving work to private firms unless they are known to have an efficient staff to supervise it, as if they do the work at estimated rates, they will probably *compensate themselves by increasing their profit*. Nor do I consider there will be any real economy in the execution of works, *vide* my remarks against (1).

(5.) As regards the maintenance of buildings, I am strongly against this being handed over to private firms except in cases where buildings have been erected by them, in which case they should also maintain them. At present the money allotted is fully spent on the building, whereas if a private firm were given a lump sum the repair work would be cut down to a minimum, in order to increase the profit. I see no reason, however, why the repair should not be handed over to the department to which the building belongs, as has been done in the case of the Police; the head of the office could then be held responsible for the proper repair of his building. This would relieve the Public Works Department of a considerable amount of work and consequently lead to a reduction of lower subordinate establishment, as it would only be necessary for the district engineer to inspect a building once a year and give a certificate that it was in proper repair or if the building was not in proper repair to submit a report, pointing out what was required, to the head of the department. In the case of local buildings this would be done by the district board engineers.

(6.) **Maintenance of roads.**—This is impossible through any private firm or contractor; I understand it was tried in Banda several years ago and proved a failure. The contractor allows the road to get into bad repair, pocketing the money which should have been spent on petty repairs, and finally a large sum has to be spent on special repairs. The subordinate establishment of the Public Works Department could, however, be considerably reduced by handing over all local roads to district boards.

(7.) The introduction of lump sum contracts, which though permitted by the Code are seldom used, might help to encourage private firms and contractors. It might also serve to encourage the establishment of quantity surveyors which would form an outlet for engineers who fail to get government employment.

(8.) In the case of buildings erected and maintained by private firms, they should be subject to inspection by Superintending Engineers.

3,660. (III.) **Changes in organization.**—As the Committee have made no definite proposals it is impossible to answer this question, but the following proposals are made for reorganizing the Public Works Department and effecting economy.

(1.) That all local buildings and roads should be taken over by the district boards for construction and maintenance. For large buildings which require better professional supervision than they are able to afford, the services of the Public Works Department engineers can be requisitioned. The handing over of local works to the district board is not a thing that can be done in a hurry; it will have to be done gradually, as suitable engineers become available, but as a start the services of all temporary engineers at present in the Public Works Department might be dispersed with, so that they would be available for district boards.

(2.) Districts should be divided up into first, second and third class. First-class districts would chiefly be head-quarters districts, such as Allahabad, Lucknow, etc., and the sub-

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divisional officer should in each case be a qualified engineer. Second-class districts, would be those in which there is a considerable length of provincial roads to maintain and the sub-divisional officer should be :—

1st junior qualified engineers,
2nd sub-engineers and supervisors, and
3rd overseers.

Third-class districts would be districts in which there are practically no provincial roads, such as Ballia, Bahraich, etc. The few provincial roads and buildings in these districts might be looked after by the district board engineers, or if considered necessary by an overseer, who, at the outside, would only require one subordinate to assist him.

(3). The staff of every district office should be increased. The district office is the disbursing office and the starting point of all accounts, irregularities, etc. I consider it absolutely essential that every district office should have a qualified accountant; this accountant should be on the cadre of the Accountant-General's audit clerks, so that in the event of an office getting into disorder the Accountant-General will be able to remove the accountant and put a better man in his place. Under the present system the districts are in charge of junior engineers, supervisors or overseers, with little or no knowledge of accounts and procedure. The head clerk, though he may have a fair knowledge of procedure, has little knowledge of accounts, except what he has picked up in a divisional office; he is, therefore, not in a position adequately to help and keep his sub-divisional officer straight in matters of accounts. By having a trained accounts clerk, he will be in a position materially to help his sub-divisional officer and prevent him from committing irregularities. By this means irregularities and audit objections should be reduced to a minimum. Besides the accounts clerk there should be at least one head clerk, and one second clerk whilst in large districts possibly a third and fourth clerk will be necessary.

(4). The accounts section in the divisional office should be abolished, the accounts going direct from the sub-divisional officer to the Accountant-General for compilation. The Accountant-General would then deal direct with the sub-divisional officer as regards irregularities and objections, except in cases which call for special action by the divisional engineer, in which case the divisional engineer would be informed by the Accountant-General. By this means there would be a considerable saving of superfluous correspondence through the divisional office. The Executive Engineer would have more time for the supervision of work and for the preparation and scrutiny of projects. There would be a saving in establishment in the divisional office. If this is approved I would suggest that the drawing section of the divisional office be slightly increased, so that more projects be prepared in that office, leaving only minor projects to be prepared in the sub-divisional office.

(5). I would not suggest the reduction of the number of divisions at present, but I think there is no doubt that, if the above suggestions are given effect to, the size of divisions could be increased and their number consequently reduced.

(6). The number of circles, also, should not be reduced, but the powers of Superintending Engineers should be increased, so as to reduce the quantity of work in the Secretariat office.

(7). As regards the Secretariat office, I would suggest that a second engineer be attached to the Chief Engineer, together with a competent staff, solely for checking projects and giving assistance to engineers in the matter of calculations and preparations of projects. This officer should be a good mathematician and should in no way be burdened with ordinary routine work.

3,661. (IV.) Relations with other departments and sub-branches.—As far as I am aware the Public Works Department meets the needs of other departments. The chief complaint is as regards the delay in preparing and carrying out small works; this is due to no fault of the Public Works Department but rather to the system and could be greatly reduced if more powers were given to sub-divisional officers. But in this case

all sub-divisional officers must be qualified engineers and not subordinates.

(2). As regards the Sanitary and Electrical Branches, I am of the opinion that they require extending and that each branch should have its staff of trained engineers, the present system of expecting one engineer to do drainage, electrical and several other kinds of engineering is unsatisfactory. A start has already been made in this direction in the Sanitary Branch and the development should be encouraged.

(3). As regards the Architectural Branch, I am of the opinion that the Architect should not only prepare designs, but also the estimates for all works he designs, so that he can keep in touch with the cost of the building and make alterations when necessary; the present system of having the design of the Architect estimated in the district concerned is unsatisfactory, as sub-divisional officers often do not take the trouble to keep down the price and are careless as to the ultimate cost, with the result that the Architect is often required to cut down his design to cheapen the cost. By having an adequate staff of computers, and dealing direct with the department concerned, the Consulting Architect would be able to send out his projects complete in every detail and a lot of correspondence would be saved.

(4). Further, I would suggest that a few engineers be attached to the Consulting Architect, in order to supervise his works and see that they are properly carried out.

3,662. (V.) Decentralization.—Further decentralization is necessary. The powers of all officers should be increased, but this is a question which requires careful consideration and can be best settled by the Public Works Department itself.

I, however, make the following suggestions :—

(1). *Superintending Engineers.*—Their powers of technical sanction should be increased up to Rs. 75,000 and they should be empowered to appoint, dismiss or dispense with the services of overseers and sub-overseers. Full powers should be given to all temporary and officiating Superintending Engineers.

(2). *Executive Engineers.*—Powers of technical sanction should be enhanced, as the officer gains experience. At present an officer of 20 years' service has no more power than another considerably his junior. A graduated scale for 10, 15 and 20 years' service is suggested.

Rs. 5,000 for 10 years.

Rs. 20,000 for 15 years.

Rs. 30,000 for 20 years.

He should also be allowed to accept tenders up to these limits.

(3). *District Engineers.*—To have powers of technical sanction up to Rs. 1,000.

The Sanitary and Electrical Branches should be separated from the Roads and Buildings, except that the Chief Engineer should control all the branches.

3,663. (VI.) Simplification of procedure.—The Public Works Department Code is in some points restrictive, and there is no doubt that it requires revision, but this can only be done by a competent officer who has had experience of the Code, and in consultation with the other officers of the Department. The following are a few of the points which need revision.

(1). Purchase of all European stores should be permitted in India; these stores are more generally rolled steel joists, angles and tees, paints, etc., all of which are required urgently as soon as an estimate is sanctioned, and if indented for from England the delay in receiving the articles would almost always prevent a work being completed within the financial year. The orders regarding the indent on England should, therefore, be abolished, and further the Executive Engineer should be given power to sanction the local purchase of all stores up to the provision in the sanctioned estimate.

(2). Divisional engineers should be allowed to re-appropriate grants from one work to another under the same fund head.

(3). Powers of Executive Engineers should be increased as regards the sale of surplus stores and write-off of stock and tools and plant, as they are in close touch with work.

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(4). Preparation of estimates for annual repairs to buildings are unnecessary. On completion of a building an estimate for repairs should be sanctioned by the Superintending Engineer and be recorded in a standard measurement book. Executive Engineers should be empowered to sanction expenditure yearly up to this amount.

If additions and alterations are made to the building necessitating an increased grant for repairs, the annual repair estimate would be revised and sanctioned by the Superintending Engineer, the previous one being cancelled. Several more instances might be quoted, but the above samples are sufficient to show, that some revision is necessary.

3,064. (VII.) Practical training.—The present system of training is faulty, a good practical training on some big

work is required. Under the present system two officers for one vacancy are sometimes trained under different officers and it depends entirely on the nature of the training officer's report whether the candidate gets the job or not; if one is strict and the other lenient, the latter pupil is sure to get the billet, though he may be an inferior engineer. If this system is adhered to, the officers under training should be interchanged after six months, so as to be reported on by each training officer. It would be better if candidates were given one or two years' practical training on several big works, with opportunities to visit others, after which they should be required to pass an examination on practical training and professional knowledge.

Mr. P. H. TILLARD called and examined.

3,065. (President.) The witness stated that he was in his 15th year of service, that he at present held the rank of temporary Superintending Engineer in the Public Works Department, and that the whole of his service had been spent in the Buildings and Roads Branch.

3,066. The Irrigation Branch in the United Provinces was practically entirely separate from the Buildings and Roads Branch, and officers were not, as a rule, transferred from one branch to the other. Such transfers as did occur were more or less exceptional and were made only when officers applied for them. Irrigation circles in the province were entirely separate from Buildings and Roads circles since irrigation was confined to certain areas. But in some instances there was both a Buildings and Roads and an Irrigation engineer in charge of works in the same area, owing to the fact that buildings and roads work in irrigation circles was in the charge of the Buildings and Roads Branch. There were no irrigation engineers in districts where there were no irrigation works, and the irrigation work in the province was more or less confined to canals. These latter, however, did not necessarily run alongside roads. Hence the irrigation staff would find it difficult if they were obliged to look after roads as well as canals, i.e., if the buildings and roads work in irrigation circles were, as in certain other provinces, placed in charge of the Irrigation Branch. The introduction of such a system might be possible in certain cases, but the two classes of work as a rule should be undertaken by separate staffs and kept distinct from each other as at present.

3,067. There were 4 Superintending Engineers' circles, and 16 Executive Engineers' divisions, 4 in each circle, in the Buildings and Roads Branch of the province. There had at one time been only 3 Superintending Engineers' circles in this branch, but the present arrangement was preferable as the area of each circle was too large under the former system. There were at present 4 Superintending Engineers also in the Irrigation Branch.

3,068. Specialization in sanitary engineering should be encouraged by the Department and the Sanitary Department should be made self-contained by the creation of a construction as well as a designing branch. Sanitary and water-works should be constituted as a separate branch of engineering, and it would be advantageous to employ specialists in drainage and water-works rather than civil engineers for such classes of work. Under the existing arrangements sanitary works were constructed partly by the staff of the Buildings and Roads Branch and partly by that of the Sanitary Branch, and in his opinion the staff which designed sanitary projects should also undertake their construction. He himself had constructed the Allahabad drainage works which were now under the Sanitary Department. There would for some years to come always be a fairly uniform amount of sanitary work to justify the employment of a separate sanitary staff, as the number of large sanitary works in contemplation was considerable. His suggestion was therefore compatible with the conditions prevailing, and likely to prevail, in the province.

3,069. The Consulting Architect prepared such designs as he was requested to by the local Government, but the estimates relating to the designs were prepared in

divisional offices. He recommended that the Consulting Architect might be made responsible for both estimates and designs, since in order to frame the latter he had to obtain local information. It was quite possible when doing so to secure information in regard to the rates and classes of materials, etc. available in all parts of the province, provided a certain number of engineers were attached to the Architectural Branch, as these officers could either conduct inspections or obtain the information in writing from the head of each district, as quantities also were worked out in district offices. In cases where the net cost shown in an estimate at present was more than what the Architect anticipated the plans had to be revised by that officer and returned to the districts for the revision of the estimates. Schemes were thus sent backwards and forwards between the Architect and the district office until the amount of the estimate was finally agreed upon. Hence if the Architect were placed in a position to know what a particular scheme was likely to cost, i.e., by the transfer of the preparation of estimates to that officer, such revision of plans as might be necessary might be undertaken in the Architect's office and the necessity for sending plans to the district office avoided.

3,070. The Consulting Architect to Government checked designs that were submitted to him for criticism by Superintending Engineers. He generally, however, did not approve of plans submitted by an engineer and preferred to prepare the designs himself. Hence the present arrangement could not be regarded as altogether satisfactory as it was very difficult to work under existing circumstances. In his opinion, the Architect should design all plans of important buildings in the first instance. The present staff of the Consulting Architect was not, however, large enough to enable him to undertake the preparation of an unlimited number of designs, and when there was urgency designs had to be prepared in district or divisional offices and then sent to the Architect. He was doubtful whether this practice led to increased speed in the disposal of work.

3,071. The Consulting Architect at present had no construction staff, but only one for the preparation of designs. In view, however, of the fact that ordinary district engineers did not pay the same attention to details of construction as the Architect, and that there were a number of subordinate engineers who, while in charge of construction, were inclined to leave out details to which the Architect attached special value, he thought a special construction staff should be attached to the Architectural Branch. Such a staff could supervise works and see that such details as the Architect considered necessary were not omitted.

3,072. There were not in his opinion sufficient buildings in any single town in the United Provinces to justify the establishment of a separate buildings division in that town, and there were no towns or divisions in the province where building work was of sufficient magnitude to justify the creation of a purely buildings division. In other words, there was no divisional charge in the province that consisted entirely of buildings. A purely temporary division had, however, been constituted in connection with the Allahabad High Court; the Allahabad

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Division proper included three districts, each of which formed a sub-divisional charge.

3,673. The Consulting Architect had probably not more than three or four buildings in the whole province in progress of construction at the present time, but this amount of work was not too small to justify the attachment, for supervisory purposes, of one or two engineers to the Architect's office as each of such engineers could be placed in charge of two or three buildings. Increases to the architectural staff would be dependent on how far the Architectural Branch in the province was to be developed. His scheme would not result in the bulk of the time of the engineers being absorbed by inspection duty as each of them could ordinarily reside at the site of their works.

3,674. No electrical work had hitherto been undertaken in his circle. Hence he was not aware whether the Superintending Engineer of a circle had any relations with the Electric Inspector to the local Government. He had been in charge of his circle for about six months only.

3,675. Tenders were invariably invited when sanction was accorded to works, and contracts for entire projects were generally given out to single contractors. In cases of large buildings, however, e.g., the High Court building, projects were divided between three or four contractors. The system of entering into separate contracts for earth-work excavation, masonry work, etc., was very seldom followed in the United Provinces, but a separate contract for wood-work was occasionally entered upon. In addition, iron and structural steel-work was sometimes purchased by the Public Works Department on behalf, and for the benefit of, contractors.

3,676. Tenders were invited usually on rates and not on lump sum contracts, and changes in designs rendered the practice of giving out works on lump sum contracts undesirable, as it was difficult to work lump sum contracts in cases where changes in design were necessary. Hence though lump sum contracts were permissible they were not entered into by the Public Works Department. He personally did not consider this a valid reason for not utilizing such contracts and thought it desirable that designs should be so prepared as to obviate subsequent alterations. To the contention that changes in designs did not cause inconvenience in working lump sum contracts in countries like England, he replied that the lump sum system would cause trouble in India when it was necessary to make additions or alterations to designs and that most of the contractors who were usually employed would not understand the system. By this he meant that the contractors generally engaged by the Public Works Department were merely suppliers of labour and that the majority of them did not understand contracting, estimating, etc., and consequently that they were not sufficiently advanced to undertake lump sum contracts.

3,677. Plans of works were made available for reference by contractors in the Public Works Department offices concerned when tenders were invited. Contractors were expected when tendering to enter their own rates for each class of work but they nearly always accepted the rates in the Public Works Department schedule or tendered at rates that were a percentage above or below those contained in that schedule. Occasionally, however, contractors furnished a list of rates that were entirely their own. As the rate for iron-work in the schedule of rates was not always correct by reason of the fact that it fluctuated, certain contractors varied their rates for iron subsequent to the acceptance of a contract. Contractors who were particularly keen on obtaining particular works invariably tendered at a percentage below the schedule of rates, but reliable contractors generally tendered at the rates in that schedule or at a very small percentage below them. His experience had been that tenders were seldom put forward at rates above those in the schedule of rates. Tendered rates therefore generally corresponded with the schedule of rates or were slightly below them.

3,678. Though he was not able to state definitely how many firms of reliable contractors capable of undertaking

reasonably large contracts were available in the United Provinces he remarked that there were very few such firms, if any. He knew of no firm of contractors in the province which employed a competent engineering staff, but named a firm of consulting engineers, who, though they undertook contracts for buildings, did not like to be classed as contractors.

3,679. Structural steel-work was not ordinarily, but occasionally, supplied to contractors by the Public Works Department as contractors generally supplied their own steel for small works. Though it was intended that structural steel should be obtained by requisition on the Secretary of State, the practice had not been adopted for the large number of small works that were ordinarily constructed in the province owing to the fact that it took about six months to get an indent for such material complied with. It would not be possible, if the India Office were indented on for all the structural steel that was required for such works, to get the latter completed in time. Hence structural steel was ordinarily obtained in India. It was not the general, but only the occasional practice to give out a separate contract for structural steel-work.

3,680. There were no government brickfields in the United Provinces as far as he was aware, and bricks were very seldom supplied by the Public Works Department to contractors. Separate contracts for bricks were only entered into during collection of material preparatory to starting a work, and were more the exception than the rule.

3,681. Cement was usually supplied by contractors and not by the Public Works Department, but in cases in which contractors desired arrangements to be made for its supply it was obtained from the Calcutta firms or from the Katni company. There were no general stores in the province in which articles purchased from England were stocked and issued to contractors, and contractors as a rule undertook in their contracts to furnish their own materials.

3,682. Ordinary repairs to tools and plant were undertaken by private firms, or workshops like the Lucknow Iron Works, and also by the Roorkee workshops and technical schools since there were no Public Works Department workshops in the province. No difficulty had been experienced by allowing the ordinary repairs to tools and plant to be undertaken by private enterprise. The necessary repairs to the mathematical instruments of the Public Works Department were undertaken by the Government Mathematical Instrument Office at Calcutta.

3,683. The provincial Public Works Department undertook the construction of contribution works on behalf of public bodies like school committees, and occasionally also on behalf of private individuals. It was permissible for the Department to construct contribution works on behalf of private persons, but it had not been made the general practice and was only resorted to in exceptional cases. As an instance of a contribution work erected for a public body, he cited the Canning College at Lucknow. There were two classes of contribution works, viz., those for which a government grant-in-aid was given and those for which the money was wholly contributed from private sources. Certain of the educational institutions which had been erected by the Public Works Department on behalf of private bodies were treated as grant-in-aid works and the others had been erected with purely private contributions. When government made a contribution towards a work it did not do so on the understanding that the work should ordinarily be constructed by the Public Works Department, but only on the understanding that it should be open to Public Works Department supervision. Completed contribution works were subject to the approval of a government engineer. As an instance he cited the Jumna Mission School at Allahabad.

3,684. The charge of 23 per cent. levied by the Public Works Department on contribution works covered all charges including tools and plant. Government, however, waived the charge in many instances as private bodies complained of being hard pressed and being

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unable to afford it. He admitted, however, that the figures furnished in his written statement showed that contribution works were invariably constructed by the Public Works Department for private bodies free of charge, but this he argued confirmed the view that the work of the Public Works Department was done cheaply; otherwise private persons and bodies would go to private enterprise.

3,685. Minor works of district boards costing less than Rs. 3,000 were in charge of overseers and sub-overseers, and this subordinate establishment constituted the sole engineering staff of the boards. As far as buildings were concerned, district boards were self-contained for all works of construction worth less than Rs. 3,000, e.g., primary schools for which this sum was the limit that had been fixed. The boards also in most districts maintained all second-class roads, i.e., the unmetalled roads and the bridges on them, but all metalled roads in the province and sometimes the bridges on second-class roads were in the charge of the Public Works Department.

3,686. He recommended that the district boards might take over all local works in their respective districts with the exception of provincial roads, e.g., local roads, schools and other district board buildings, provided that they employed qualified engineers and did not place subordinates in charge of their works. The provincial roads were the main thoroughfares in the districts and one of them was the Grand Trunk Road. Provincial roads, however, were not the only first-class roads in districts as certain of the local roads which he had suggested might be transferred to district boards were also classed as such. If a district board required the services of provincial engineers for the construction of a particular building, the Public Works Department could arrange to supervise the work. In addition to provincial roads, he considered that government buildings also ought to remain in the charge of the Public Works Department, at least for the present. Such a scheme, if given effect to, would not result in much duplication of the engineering staffs in the districts as the provincial staff would be considerably reduced with the augmentation of the present district board establishments.

3,687. He suggested, in order to further curtail duplication of staff, that the districts of the province might be divided into three classes according to the amount of work there was in each. Those districts where there were numerous roads and buildings, e.g., Allahabad, might be classed as first-class districts, and in such districts there might be both a district board engineer as well as a Buildings and Roads provincial engineer, in charge of district board and government work respectively. Second-class districts might be those with a somewhat less amount of buildings and roads work (government and district board) than first-class districts under provincial engineers maintained for recruitment to first-class districts, supervisors or overseers. The remaining and least important districts might be converted into third-class districts, and even the provincial roads and government buildings in these might be placed under the district board engineer; or the government buildings and provincial roads in charge of an overseer. Such a scheme would reduce the number of Public Works Department subordinates considerably and it was based on the assumption that it was the intention to reduce the establishment of the Buildings and Roads Branch. Since in certain backward districts the district board expenditure was large while the corresponding expenditure of government was limited, owing to the fact that there were very few government buildings and provincial roads in those districts, he recommended that the experiment be first tried in third-class districts. Certain of these backward districts were more developed in so far as district board works were concerned than some of the first-class districts. In support of this view he mentioned the Basti district, where a considerable number of district board schools were under erection and roads were being extended. If his scheme were introduced for a start in first-class districts, it would not much curtail the duplication of staff. For instance, the civil district of Allahabad was at present divided into three sub-divi-

sions and, if the experiment was tried first in such a district, there would still be duplication in that two engineers in place of three, viz., a district board engineer and a Public Works Department engineer, would have to be employed, as the work would be too heavy for a single district board engineer. Though after the transfer of works to district boards there would still be a certain amount of duplication of staffs in districts, his idea was to economise provincial funds by a reduction in the number of Public Works Department subordinates. A system under which the whole of the government works in districts was handed over to district boards had been tried in Bengal, but he was not aware whether it had proved satisfactory or not, nor did he know whether such a system had ever been tried in the United Provinces.

3,688. The figures in the statements he had furnished with his written evidence showing the cost of Public Works Department establishment under several heads were obtained from the Accountant-General. He was not aware how that officer had arrived at the figures. As the Department did not maintain a separate establishment for contribution works, he was not aware how the Accountant-General had arrived at the figure of 2 per cent. shown in the statements.

3,689. The Public Works Department should be relieved of the repairs to government buildings which were occupied by other departments by entrusting the repairs to those departments, subject to inspection once or twice a year by the engineering department. Such a system, without inspection of work by the Public Works Department, was at present followed in connection with certain buildings belonging to the Police Department, e.g., police *thanas*. These buildings were, however, only minor works, and though they were maintained by the Police Department they were mainly constructed by the Public Works Department. The Police Department had power to construct certain small buildings, and only police offices at the headquarters of districts were maintained by the Public Works Department. Inspections of Police Department works were not conducted by officers of the Public Works Department as there were no rules to that effect. The Police Department were, however, empowered to requisition the services of the engineering department in the case of special repairs, additions or alterations to buildings executed by them. The repairs undertaken by the Police Department, though they could not be regarded as first-class, were generally carried out satisfactorily.

3,690. Craftsmen who might safely be entrusted to undertake petty repairs without professional supervision, e.g., white-washing, mending doors, stopping a leak in a roof, etc., were available in the province. Consequently he did not agree with the contention that the building trades were not sufficiently advanced in India as in England so as to allow of an individual who desired a house repaired or painted sending for a jobbing builder or jobbing painter to carry out the work with reasonable efficiency, but without expert supervision. In his opinion, the Public Works Department should only be responsible for repairs of a structural nature.

3,691. If all government buildings and roads in districts were transferred to district boards, the repairs to such buildings might also be made over, provided the boards employed qualified engineers to supervise the repairs by annual inspections, when the repairs were done by the department in occupation. On the other hand, if his suggestions were given effect to and district boards were made responsible for district board works, and local roads, and the Public Works Department responsible for government buildings and provincial roads, repair work to government buildings ought to be entrusted to the several departments in occupation subject to the supervision of the Buildings and Roads staff of the Public Works Department.

3,692. A fixed allotment was made for annual repairs to each government building, and repair estimates had to be prepared in April for work to be done in October. Repair works were ordinarily carried out by contractors subject to supervision by subordinates and inspection by the engineer in charge of the

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district. A certain amount of detail was necessary in the preparation of repair estimates and a large amount of such detail was abstracted from standard measurement books. Detailed repair estimates were, however, unnecessary, and the amount allotted for repairs should be placed at the disposal of the Executive Engineer with discretion to spend it as he liked. Repair estimates in his opinion ought to be sanctioned once and for all and not framed every year as was the present practice. They were as a matter of fact largely hypothetical in that they were prepared so long before actual repair work was started that it was not possible to estimate before the rains what damage was likely to be caused by rain. Consequently, unforeseen repairs had often to be carried out. He did not think that the Executive Engineer was in a better position under the present system to see that funds were actually spent on particular items of repair than he would be were repair estimates abolished.

3,693. Three of the school buildings that had been erected by a certain private firm in the United Provinces for the Department of Education had been inspected by him when they were almost completed. It was therefore not possible for him to state what materials had been used in the foundations and walls, but so far as he was able to judge from their outward appearance the buildings appeared to be quite sound. The private firm had employed a contractor on actual construction work, and had merely designed and supervised the work of that individual. A different contractor had been employed by the firm on each of the three buildings. No Public Works Department officer had inspected the schools during their construction, since the officer who had at first been put on to inspect the school at Gorakhpur had been withdrawn. A certain amount of finishing work had yet to be carried out in each of the three school buildings before they could be handed over to the Department of Education. As these buildings had not been inspected by officers of the Public Works Department during construction, they should be maintained by the private firm for either a suitable period of years or altogether, in order that if faults in their construction subsequently came to light the firm might be responsible for rectifying them. A comparison of the rates at which these buildings had been erected by the firm with those of the Public Works Department had not been made by him as he did not know the firm's rates, but he understood that the works had been executed at rates that were under those contained in the Public Works Department schedule. He surmised that the private firm would probably have refused to inform him of their rates.

3,694. All Superintending Engineers in the United Provinces except temporary or officiating Superintending Engineers (for whom the limit was Rs. 10,000) had had delegated to them technical powers of sanction up to a limit of Rs. 50,000. He recommended that the limit for all such officers, whether permanent, temporary or officiating, might be increased to Rs. 75,000, but the powers of individual officers might be varied according to length of service between the two amounts.

3,695. He recommended the following scale of technical sanction for Executive Engineers. Officers with 10 years' service Rs. 5,000, those who had served for 15 years Rs. 20,000 and those who had served for 20 years and over, Rs. 30,000. The scale, he considered, would place officers in a better position to exercise control when they were promoted to the rank of Superintending Engineer. These were only rough figures; he, however, favoured a more liberal scale for divisional engineers.

3,696. The powers of Superintending and Executive Engineers for the acceptance of tenders might as at present be limited to the amounts he had recommended as limits to their powers of technical sanction. He admitted, however, that on principle the powers of officers to accept tenders should be higher than their powers of technical sanction and agreed that such a procedure might be adopted.

3,697. He did not agree with the suggestion that, in order to avoid the submission of revised estimates, the present 5 per cent. that was allowed for contingencies should be increased to 10 per cent., as he thought there

was no reason why an excess need occur if estimates were carefully prepared.

3,698. Powers of appointment, dismissal and punishment of even a lower subordinate in the lowest grade were vested solely in the Chief Engineer so far as the permanent establishment of the Public Works Department was concerned, and neither Superintending nor Executive Engineers could dismiss a permanent lower subordinate without reference to that officer. Superintending Engineers had, however, power to appoint or dismiss temporary lower subordinates and to fill vacancies in the lower subordinate permanent establishment. Superintending Engineers could only disallow a portion of a lower subordinate's travelling allowance as a punishment. Hence the present arrangements were unsatisfactory and certain disciplinary powers over the permanent establishment should be given to both Executive and Superintending Engineers. He, therefore, agreed that powers of punishment, including dismissal, subject to an appeal to the Superintending Engineer, should be given to Executive Engineers over lower subordinates, and similar powers over upper subordinates to Superintending Engineers subject to an appeal to the Chief Engineer.

3,699. Executive Engineers should be given certain powers of reappropriation of funds. To meet the contention that unlimited powers in this respect might lead to a divisional engineer ignoring the requirements of other departments, i.e., that such an officer might reappropriate funds from a work that a particular department considered urgent to another which was not considered as urgent, he suggested that Executive Engineers might only be permitted to reappropriate savings on works on the principle that funds allotted to particular works should be spent on those works. In his opinion Executive Engineers could safely be entrusted with such power if they were informed beforehand as to the urgency of their several works, and such a practice would not result in executive officers following their own whims and fancies in regard to the order in which they constructed works.

3,700. For each vacancy in the Assistant Engineer grade in the United Provinces two candidates from Roorkee were selected to undergo a course of practical training and one of them was ultimately selected for the permanent appointment according to the reports received on their work. He was not in favour of this system as it was too much dependent on the personality of the officers under whom each candidate served. He, therefore, recommended that it might be abolished. He added that practical training should on principle be given to all students who passed out from Roorkee and selections to government appointments made at the end of the practical course. There would always be sufficient work in progress under the Public Works Department, private firms and municipalities in the United Provinces and also in other provinces, to afford such a practical training to the average number of students turned out yearly from Roorkee, viz., 15.

3,701. He had had considerable experience of both classes of subordinates during the 15 years of his service. In his opinion the theoretical training given at Roorkee to upper subordinates was excessive as long as such officers remained in the upper subordinate grades, but it was better for them to be over-trained than under-trained since they were likely to be appointed to higher appointments than overseer, such as sub-divisional officers in charge of districts. The theoretical training given to lower subordinates was adequate for the work they performed in the lower subordinate grades, but such individuals needed better qualifications in order to be promoted to upper subordinate grades, such as overseer. His general opinion, however, of the theoretical training given at Roorkee to men who entered the subordinate branches of the Public Works Department was that it was not excessive.

3,702. There were several classes of *mistris* in the United Provinces comprising both good and bad workmen, but a substantial proportion were of superior ability. These latter were practical men who had been trained in construction work and ought to make very capable lower

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subordinates. Hence he approved of the suggestion that a certain proportion of the lower subordinate establishment might be recruited from the *mistri* class and considered that class to be a good field for recruitment for the purpose. Most *mistris* had also a working knowledge of English and he did not think this class would need further instruction in English before promotion to the lower subordinate grades. Certain *mistris* made capable surveyors and were able to take measurements satisfactorily. Hence if it were desired to recruit good practical men, without theoretical knowledge, the material was available in the province.

3,703. The standard up to which the building trades in the United Provinces had progressed was in his opinion sufficiently adequate for the class of buildings erected in the province, as both capable masons and competent craftsmen were available. He did not therefore desire to recommend any improvement in this respect.

3,704. (*Sir Noel Kerahur.*) Reliable private firms capable of carrying out works without the aid of the Public Works Department did not, as far as he was aware, exist in the United Provinces. The absence of such firms might be considered a misfortune from the point of view of the development of the industries of India, and the existence of the Public Works Department was to a certain extent the cause of this absence.

3,705. The provincial Public Works Department carried out most of their work with the aid of Indian contractors who employed their own *mistris*. Personally, he had never allowed a contractor to undertake the entire setting out of a work, and though *mistris* were quite capable of setting out a work, this duty was performed generally by sub-overseers and other subordinates of the Public Works Department. In addition to setting out, subordinates were also required to supervise works, and construction work required constant supervision. Hence the services of subordinates could not, in view of the admitted capabilities of *mistris*, be entirely dispensed with. No advantage would be derived by allowing a contractor to set out a work, nor would such a practice help towards improving the general standard of contractors.

3,706. In respect to the following remark in his written evidence:—"A certain municipality entrusted a portion of their drainage scheme to private enterprise. The firm was paid Rs. 7,355 for an estimate of approximately Rs. 7 lakhs, which was beyond the means of the municipality," he explained that this amount was paid to the private firm for preparing the estimate of Rs. 7 lakhs. Further that his succeeding remark that "This was subsequently revised by the Sanitary Department to Rs. 1½ lakhs" implied that the cost of the scheme was cut down from Rs. 7 to Rs. 1½ lakhs. The 17 per cent. paid to the private engineer was the percentage that was paid on all expenditure against the Rs. 1½ lakh estimate, exclusive of the sum of Rs. 7,355. He admitted that his comparison of these charges with the rates at which the Public Works Department had constructed an extension which that particular municipality required was not a fair one owing to the fact that sanitary underground work was notoriously uncertain, and that good ground might have been met with by the Public Works Department and unsuitable ground encountered by the private firm.

3,707. The charge fixed by Code rule for the construction of sanitary work by the Public Works Department was 12 per cent., exclusive of the Sanitary Engineer's fee of 1 per cent. and not 23 per cent. The latter figure was the charge made by government for the construction of contribution works, in cases where no relaxation of the rules was granted.

3,708. The Public Works Department practically always carried out works at their schedule rates, but he could not state definitely that they never executed work at rates in excess of those rates.

3,709. In connection with the statement in his written evidence to the effect that a certain Calcutta firm had asked Rs. 25,000, or nearly 50 per cent. more than the Public Works Department estimate of Rs. 60,000 to con-

struct a building for the Baptist Mission at Barisal, he admitted that he did not believe that a private firm would charge 50 per cent. for supervision only, and explained that the firm had probably not found it worth their while to undertake that particular work unless they made a considerable profit. The extra 50 per cent. was, therefore, not charged for supervision only. In view of this fact he admitted that the comparison he had drawn of this percentage with the Public Works Department charge of 23 per cent. was not a fair one, but explained that his statement had been based on hearsay.

3,710. Individuals who requested the Public Works Department to construct contribution works on their behalf occasionally knew whether they would be charged for supervision for such works or not, since when making an application they asked in certain instances for their works to be carried out free of charge.

3,711. By the recommendation in his written evidence to the effect that the Chief Engineer might be given a second Assistant, together with a competent staff solely for checking projects, he implied that the Chief Engineer was at present over-worked. He had not considered the question of affording relief to that officer by removing, not a portion of the engineering work but the whole of the Secretariat work, as he thought that the Chief Engineer ought to keep in touch with both his professional and Secretariat work. It was true that the first duty of an engineer was engineering, but his idea was to lessen the Chief Engineer's work by giving that officer an extra Assistant who might help in the preparation and checking of projects. It was inadvisable to relieve the Chief Engineer of his Secretariat duties.

3,712. He had recommended that engineers and not Architects might be attached to the Consulting Architect's office because it was desirable that an engineer should supervise construction. He admitted that an Architect might be more useful, more especially in matters of detail, and that instead of an engineer it might be advisable to employ an Assistant Architect, but he did not think it would be possible to obtain Architects who would be willing to serve under the Consulting Architect.

3,713. (*Mr. MacLennan.*) The second Assistant to the Chief Engineer, whose appointment he had suggested, should be an officer who would undertake the more laborious and less important part of the Chief Engineer's work, i.e. work that the Chief Engineer ought not perhaps be called upon to perform.

3,714. The Public Works Department did not make a separate charge for the preparation of plans and estimates in addition to their charge for establishment, but if plans and estimates were prepared by contractors an extra charge would be made for them, even if the contractors eventually carried out the works. The Public Works Department charges for establishment included the preparation of a large number of schemes which never materialized. Hence the percentage charges of establishment to works was somewhat misleading.

3,715. (*Rai Bahadur Ganga Ram.*) The difficulty in connection with works that were designed by the Consulting Architect or Sanitary Engineer to Government and which were carried out by the Public Works Department staff lay not in the fact that this staff were incapable of properly interpreting plans, but rather that they did not pay sufficient attention to details. Further, subordinates were in charge of works in certain districts and construction was in consequence occasionally supervised by a subordinate. To obviate the difficulty experienced engineers might be attached to the Consulting Architect's office and supervise works in districts. It was the duty of an engineer, to whom an architect's design was sent, to check the stability of the building proposed as shown by the design, and to point out to the architect any defects that might come to light, and if the latter held to his design and did not agree with the engineer the responsibility for defects in construction ought to rest with the architect. Most architects claimed they were able to calculate the stability of buildings; in fact, they alleged that they were more qualified to do so than engineers.

3,716. The area of his circle comprised three Commissioner's charges, but the jurisdiction of the divisional

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Executive Engineers under him did not coincide with the civil divisions.

3,717. The system under which public works in each district were in charge of a district engineer, sufficiently qualified to hold charge of a sub-division and to conduct both provincial as well as district board works under the Superintending Engineer and Collector respectively, was to a certain extent in force at present in that a certain number of government works were carried out by district boards. It was probably before his time that this system had been generally in force throughout the province.

3,718. If Public Works Department officers were authorized to grant advances to contractors on security that might be considered by civil officers to be sufficient, the practice would not tend to cheapen rates. He was not able to state whether, if advances were given to petty contractors, in order that such individuals might refrain from borrowing money, rates were likely to be reduced. He thought, however, that such a practice might have this effect.

3,719. When submitting first stage plans for administrative sanction, Executive Engineers furnished merely line plans, and the cost was calculated at a certain amount per square foot of plinth area. He was not aware of any tabulated statements in the United Provinces, such as were available in the Punjab, showing by plinth areas all the important buildings in each district and the actual cost of each building.

3,720. There were upper subordinates in the province who were not considered fit to hold charge of sub-divisions, and government should be in a position to dismiss such officers if such a course were considered appropriate. It did not, however, necessarily follow that because an officer was not considered fit to hold charge of a sub-division he was not a good upper subordinate. He was here informed that it had been put forward in evidence by an Executive Engineer that certain lower subordinates under him were considered to be more fit to hold charge of a sub-division than particular upper subordinates, and he recommended that in such cases powers might be given to the Chief Engineer to dismiss a particularly inefficient upper subordinate.

3,721. The Public Works Department in the United Provinces did not, as in the case of the Government of Bombay, make a charge of 2½ per cent. for the preparation of designs for local works, but charged a fixed percentage for the whole of the works in a district.

3,722. Bills received for maintenance of works were paid on measurements and not in lump sums. He did not know the practice followed in the Police Department nor how the Accountant-General passed that department's accounts for maintenance work.

3,723. The percentage calculated on the capital cost of buildings for maintenance charges varied between 1 and 1½ per cent. according to the size of the building. The percentage was 1½ for a large building.

3,724. Since the distinction between repairs and original works did not adversely affect the efficient working of the Department, no change in the present rules was needed in this connection.

3,725. The staff of the Irrigation Branch had been utilized in exceptional cases for the construction of small isolated buildings located near the headquarters of an Irrigation area as the result of a mutual arrangement between the two branches.

3,726. (Mr. Cobb.) He adhered to his contention that one of the objections to lump sum contracts was the likelihood of extensive additions and alterations being subsequently necessary. The only manner in which to obviate this difficulty was to prepare more detailed plans and estimates in the first instance. Otherwise, it was not possible to check additions and alterations as long as individuals, in the Civil and Public Works Departments were allowed to inspect buildings and to suggest them. There was no objection to preparing more detailed plans and estimates, but this would necessitate the employment of a larger staff in order to avoid delays.

3,727. Contractors did not often tender at low rates and depend on the Public Works Department to increase

the rates subsequently in order to ensure their receiving particular works, since when they did so they generally did not receive the works tendered for. He knew of cases, however, where contractors had tendered at rates which were a great deal too low and had afterwards complained of being unable to carry out the work unless the rates were increased. In such cases the Public Works Department officer had either to stop the work or admit the contractor's demands. A rate which in his opinion was too low was one in which the difference involved was about 7 or 8 per cent.

3,728. Certain standard repairs to buildings, such as white-washing, had to be carried out every year, and such repairs absorbed a large amount of money. Repair estimates included, in addition to the cost of standard repairs, such items as repairs to windows and doors that might become necessary before October. If this margin was not sufficient the sums allotted for the estimated repairs had to be reduced, and such practice was the cause of a good deal of friction with the individuals who occupied residential buildings. The annual repairs estimate, however, applied to minor repairs only as special repair estimates were prepared for the more urgent and serious damages, etc.

3,729. The principle of selection was practically entirely ignored in the service at present, but he did not think it necessary to enforce it further in future since, even at present, an Executive Engineer who proved himself to be unsuitable might be reduced. Each Executive Engineer should at least be given a trial when, according to seniority, his turn for promotion came round.

3,730. (President.) All payments were made in the United Provinces by sub-divisional officers. Relief might be afforded to Executive Engineers by the transfer of the accounts work to sub-divisional offices, i.e., if each sub-division maintained its own accounts. There were generally three districts in each division and there was generally an accounts clerk for each of the three districts in the divisional office. In this way the compilation of the divisional accounts was concentrated in the offices of Executive Engineers, and though payments were made in the district office, that office sent all its accounts for compilation to the divisional office. He contended that as under this system the initial mistakes, objectionable payments and wrong allocations, etc., were made in the district office, a trained accountant was essential in that office in order to advise the sub-divisional officer. The district accounts ought then to be sent from the sub-divisional office direct to the Accountant-General. He met the contention that this would entail much extra work on the Accountant-General, in that instead of 16 sets of divisional accounts that officer would have to deal with about 50 sets of sub-divisional accounts, by the remark that the Accountant-General had a sufficiently large staff. He anticipated that his suggestions, if accepted, would allow Executive Engineers more leisure for inspection and supervision of works.

3,731. It was inadvisable to reduce the number of Superintending Engineers, and to the contention that such officers would be unnecessary if a better class of Executive Engineers to whom increased powers might be given were available, he replied that the possibility of abolishing Superintending Engineers depended on the extent of the powers it was proposed to give to Executive Engineers. Those officers would have to be given powers up to the present limits fixed for Superintending Engineers, and unless this were done the work of the Chief Engineer would be very considerably increased, since all estimates would have to go to his office for technical sanction. Further, from his experience of the working of the Department, he did not think it would be an improvement in organization to dispense with the services of the Superintending Engineer. The value of that officer's inspections of works in progress and check of estimates fully justified the existence of his appointment.

3,732. The Chief Engineer at present had one Assistant. He adhered to his contention that a second Assistant of about the status of an Executive Engineer should be attached to the office of the Chief Engineer, but explained that this appointment would not be necessary if his sug-

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gestions for the increase of both Superintending and Executive Engineers, powers of technical sanction and acceptance of tenders were accepted; it would only be

necessary if the present organization of the Department were retained.

RAI BAHADUR BEHARI LAL, Contractor.

Written Statement.

3,733. I should like to urge before the Committee appointed by the Government of India to inquire into and report generally upon the organization and system of administration of the Buildings and Roads Branch of the Public Works Department the following points which will in my opinion bring about efficiency and prove beneficial from an economic point of view.

3,734. The present organization of the staff requires such modification as stated below:

(a). Every division should consist of six districts as was the case up to the year 1907 at a time when there were not the motor facilities that are provided to-day and not three districts as is now the case. I do not think that such an arrangement will be too heavy a burden to the Executive Engineer. Again it will mean considerable economy.

(b). The existing number of circles in the United Provinces under the charge of Superintending Engineers should be reduced from four to three as was formerly the case.

(c). Larger districts should be placed under the charge of officers holding the qualifications of an Assistant Engineer and smaller districts under the charge of officers who have passed the sub-engineer's test.

3,735. (a). The Executive Engineers should be given powers to spend 10 per cent. on contingencies over and above the sanctioned estimate instead of 5 per cent. as at present.

(b). The authority to grant contracts which is vested in the district engineers at present should be transferred to the Executive Engineers.

(c). District engineers should make the measurements of works but the payments should be made by the Executive Engineers.

RAI BAHADUR BEHARI LAL called and examined.

3,738. (President.) The witness stated that he was a contractor and that he accepted all descriptions of work from the Public Works Department including building and iron-work. He had no workshops but possessed building yards. He also had his own kilns and manufactured his own bricks.

3,739. The largest works which he had ever undertaken were the construction of the Medical College and the Hospital at Lucknow. These two works were in progress simultaneously and cost about Rs. 15,00,000. He never sub-let any portion of a large contract, and invariably executed the entire work himself.

3,740. In the United Provinces tenders were invited for each and every item of the estimate and a contractor was thus obliged to furnish quotations for all the items in an estimate. It was not the practice to split up contracts.

3,741. Notices inviting tenders were advertised in the local newspapers and posted up in the engineer's office and in the law courts. Sanctioned estimates, however, were not advertised, but were available in the divisional office to anybody who desired to see them. Sanctioned rates were also shown to anybody who desired to see them.

3,742. Contractors usually filled in rates when submitting tenders but they occasionally intimated that they were prepared to accept work at a specified percentage above or below the estimated rates. Detailed quotations were furnished for all contracts and no lump sum contracts were invited. Tenders for works very seldom exceeded the rates in the schedule of rates, and were generally at schedule rates or somewhat below them.

3,743. He could not offer any suggestions for the encouragement of private enterprise. He employed no engineering staff and was not in favour of the intro-

(d). The system of employing unqualified hands among the temporary staff should be put a stop to and in time of necessity, even temporarily, only qualified Roorkee persons should be employed.

3,736. On the encouragement of private enterprise and the desirability of entrusting the construction and upkeep of certain classes of public works to agency other than departmental, I should like to mention:

(i) that the present system of contract works well and under it the supervision is conducted by the Public Works Department and the construction of public works is sufficiently economical and gives every satisfaction;

(ii) that in big cities like Calcutta and Bombay where big works on a grand scale are undertaken it may not be undesirable to entrust their construction to big contracting firms as they can without considerable difficulty get the services of capable and qualified engineers with a decent establishment, but in the United Provinces and in the smaller districts particularly, where large works are not generally undertaken, it is undesirable and uneconomical to entrust the construction of such public works to big contracting firms as they will have to entertain the services of qualified engineers from elsewhere for which they will have to pay a heavy price.

3,737. The district boards should be entrusted with the construction of minor works only up to Rs. 1,000. The Public Works Department itself should deal with the construction of works involving greater cost which means greater supervision. As it is, the district board cannot undertake the construction of large public works, and even if they employ engineers they cannot afford to have the facilities of the Public Works Department, consisting as it does of Executive, Superintending and Chief Engineers to supervise the works.

duction of a system in India under which contractors would be obliged to engage such staff, as he would have to pay an engineer a salary of Rs. 1,000 a month as compared with Rs. 100 his present monthly expenditure on staff.

3,741. He was of opinion that contracts in the smaller districts should be distributed by Executive Engineers and not by district engineers and preferred not to furnish reasons for his recommendation. He also thought that payments should be made by Executive Engineers.

3,745. The officer appointed to each district should not be below the rank of Assistant Engineer; such Assistant Engineer should not be empowered to make disbursements and payments should only be made by the Executive Engineer in order to enable that officer to know which contractors had received payment.

3,746. In his opinion no work which cost more than Rs. 1,000 should be given to district boards because they were not qualified to execute such works. District boards could employ district engineers but they would not be able to exercise adequate supervision over them. Supervision once a quarter by the Superintending Engineer would not be sufficiently effective.

3,747. (Mr. Cobb.) He objected to entrusting works in excess of Rs. 1,000 to district boards for the reason he had stated and was not in favour of an increase of the limit to Rs. 2,500.

3,748. He did not disapprove of the existing system under which all works supervision was conducted by upper and lower subordinates provided these men were properly supervised. He also had no objection to the taking of measurements by subordinates provided their measurements were checked by the district and sub-divisional officers. The present check exercised over measurements was adequate and did not result in loss to contractors.

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E. F. TITTLE, Esq., Professor of Mathematics, Thomason Civil Engineering College, Roorkee.

Written Statement.

3,749. Relation of Thomason College to Cooper's Hill.—The Thomason College is the oldest of the Indian engineering colleges and was founded in 1847, owing its origin to a training school for artisans started at Roorkee in 1845. The college is, therefore, antecedent to Cooper's Hill, which was founded in England in 1871, and with which the Indian college was on an equal footing in the matter of training men for the Public Works Department up to 1894, when the introduction of the provincial service system relegated Roorkee to a definite position of inferiority.

The constitutions of the two colleges, Thomason College and the Royal Indian Engineering College, were almost identical, but differed fundamentally from the type adopted at the engineering schools of British Universities.

3,750. Object of this Minute.—This fundamental difference lies in the fact that at Thomason College and the Royal Indian Engineering College educational management has never existed, while at the engineering schools attached to modern universities such management always predominates. It is the object of this Minute to bring forward the evidence for this statement so far as it affects Roorkee, and to endeavour to make clear the preponderating advantages attaching to the system in vogue at University engineering schools in the West.

3,751. State of technical education at time of founding Thomason College.—Both Thomason College and the Royal Indian Engineering College were originally founded to enable the Indian government to recruit suitably for their Public Works Department. In 1851 when, owing to the exertions of Mr. Thomason, the Roorkee College was first placed upon an adequate basis, technical education was in its infancy and such chairs of engineering as existed at British Universities were of recent creation. Matters were somewhat more advanced in 1871 when Cooper's Hill was started, but no widespread development of technical education occurred in England before the foundation of the City and Guilds of London Institute in 1878. It follows, therefore, that the constitution adopted at Roorkee and at Cooper's Hill must be regarded as merely tentative rather than the most suitable for colleges of their nature.

3,752. System of control adopted at Thomason College and at Cooper's Hill.—In both cases a non-educational principal or president was recognised by government as the officer solely responsible for the efficient working of the college, and under his orders the educational staff were placed for the purpose of carrying out such commands as might be issued to them.*

3,753. Later developments of technical education.—This system naturally presented few disadvantages so long as technical education was in its infancy, before any suitable technique existed, and while principal and staff were equally in the position of tentative workers and one man's opinion was as good as another's. But in the late seventies and early eighties many workers in the field of technical education began to appear. Professor Rankine's work at Glasgow began to bear fruit, the truth enunciated in his dissertation on "The Harmony of Theory and Practice" began to be appreciated and the close relationship existing between pure and applied science came to be realised in certain quarters.

* Sir Oliver Lodge writing in "The Times" of 20th February 1901 stated with reference to Cooper's Hill—"The Indian Government has attempted to run the College on military and autocratic lines, and though it had eminent educational specialists among its Professors it has not attempted to consult them or form them into a Senate or a responsible Board of Studies or give them any voice in its management."

Also in G. O. No. 2365, dated 11th December 1916, Industries Department, United Provinces to Government of India, it is stated with reference to Roorkee—"His Honour was particularly anxious to have an Engineer with practical experience in command at Roorkee."

3,754. Later engineering schools adopt system of control better suited to educational needs.—The later engineering schools developed a constitution more calculated to make full use of this relationship, and the courses of study in such institutions began to be arranged in well-defined and properly co-ordinated groups. Responsibility for the efficiency of an engineering school could no longer be placed upon the shoulders of one man; it rested with a Board of Studies or Faculty of Engineering through which alone the proper co-ordination required could be secured. Under such a system of development the engineering schools of the City and Guilds of London Institute and of certain British Universities came into existence.

Such a system of educational control never existed at Cooper's Hill, nor at Roorkee.

3,755. Secretary of State's recognition of need for modification at Cooper's Hill.—Thus, so far as Cooper's Hill is concerned, Sir W. Anson in a letter to the Secretary of State for India, dated 6th March 1901, wrote—

"It is now possible, and has actually happened, that a teaching staff of long experience, willing and competent to teach, may find their scheme of studies altered and the dismissal of some of them determined upon, without a hearing by the President."

To which the Secretary of State in his reply, dated 11th March 1901, answered—

"It is clear to me that the channels of communication between those actually teaching and those in authority over the teachers, viz., the President and visitors, should be widened and quickened."

This eventually led, in the case of Cooper's Hill, to an officially-constituted Board of Studies being called into existence, eighteen months before the abolition of the College, and thus too late to make its influence felt on developments there.

3,756. Modifications attempted at Roorkee to meet educational needs never satisfactorily inaugurated.—At Roorkee, about 1894, when the College was affiliated to the Allahabad University, a Faculty of Engineering was necessarily created, but this was allowed to die of inanition since government failed to realise the necessity for ensuring a sufficiency of Fellows competent to serve on such a Faculty.† Moreover a college Board of Studies has, through the course of events at Roorkee, come unofficially into existence, chiefly owing to the educational difficulties incident to the College work, but this Board possesses no official authority and consequently their considered opinion can always be set aside.

The whole history of Thomason College, since its reorganization in 1894-96, illustrates how the guiding authorities persistently ignored the results of educational experience and declined in any way to allow educational control to become a reality.

3,757. The Colvin scheme of reorganization.—In 1891, Sir Auckland Colvin's attention having been directed to the need for extending considerably the facilities available for technical education, he appointed a committee which made an exhaustive examination of the position.

Upon the findings of this committee he wrote—

"The recommendations of the Committee may be divided into two distinct classes: first, those which it is possible to carry into effect with little or brief delay; and second, those which are in great measure necessary to the full carrying out of the first category, and partly independent: but which all permit of being postponed for more mature consideration. The recommendations which fall into the first of these two classes are firstly, the reorganisation of the Thomason Engineering College, secondly, the institution by the Education Department, or by the University, of a School Final Examination for the modern classes of high schools: thirdly, the establishment of industrial schools at Roorkee, Lucknow or Allahabad.

† Vide Blue Book Cd. 539, dated 1901, pp. 2-3.

† Vide paragraph 5 of G. O., U. P. No. 2365 Ind. Dep., dated 11th December 1916.

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The recommendations which fall under the second category are these: *first*, the establishment of a School of Art at Lucknow; *second*, the establishment of an Agricultural School at Cawnpore; *third*, the establishment of a Teachers' Central Training College at Allahabad."

All these recommendations have since been brought into effect and all are admitted to be bearing good fruit, with the single exception of the reorganization of Thomason College. The reasons, therefore, for the failure of the recommendations in this particular instance, need very careful examination and a suitable opportunity for this is afforded by the appointment of the present Public Works Department Reorganization Committee.

3,758. *Its recommendations concerning Thomason College.*—The recommendations regarding the reorganization of Thomason College were as follows:—

(1). The transference of control from the Public Works Department to the Education Department.

(2). Affiliation to the Allahabad University.

(3). The formation of a committee of management consisting of the Chief Engineer to Government, United Provinces, Public Works Department, Buildings and Roads Branch, the Director, Public Instruction, and the Principal.

(4). The strengthening of the educational staff by the appointment of Indian Educational Service officers as professors.

The report and recommendations of the Colvin Committee clearly indicate that the trend of the developments foreshadowed was the establishment at Roorkee, upon a thoroughly scientific basis, of an educational centre for higher technological work. Further that this centre should be in touch with industrial schools for low grade work suitably scattered throughout the provinces, upon which the principal of Thomason College was required to report after periodic inspections. In confirmation of this it is stated in letter No. 286, dated Simla, 27th August 1903, Government of India, Finance and Commerce Department to the Secretary of State, that the Thomason College was "developing into an Industrial and Technical Institute which will control and stimulate teaching of all kinds in the United Provinces."

3,759. *Failure of the controlling authorities at Roorkee to understand the nature and import of the findings of the Colvin Committee.*—The principal developments, however, which actually took place at Roorkee between the years 1894—1901, were in connection with the introduction of industrial and mechanical apprentice classes which were all of a distinctly low grade type. The mere presence of such classes at Roorkee was sufficient to indicate that the Thomason College, instead of exerting any stimulative influence on industrial schools through the inspecting duties devolving upon its Principal, was in reality entering into competition with them and developing into a formidable rival of such schools.

3,760. *These same authorities discredited by Government of India for their inability to appreciate the value of educational experience.*—In 1901 a committee of inquiry, presided over by the principal of Thomason College, was appointed to examine into and report upon the whole question of industrial schools; the findings of this committee, however, were, subsequently, entirely discredited by the Government of India in a Resolution, dated 14th January 1904, wherein it was stated—

"The Government of India are unable to find in the argument advanced by the Committee, in the example of other countries, in the opinion of expert witnesses, or in practical experience in India, any reasons which would justify them in swooping away the present industrial schools, and substituting the system described in this report."

It must be admitted that such criticism very clearly shows that educational evidence and educational experience possessed little or no value in the eyes of the controlling authorities at Roorkee from the time of the inauguration of the Colvin scheme of reorganization up to 1901.

3,761. *Independent recognition of this by the local Government, but measures introduced for improvement are*

inadequate.—The Government of the United Provinces itself recognised that the system of control in vogue at Thomason College was inadequate to deal with questions of educational detail, and in 1901 they instituted a college council to consist of members of the teaching staff, and to be associated with the principal "in regulating the courses of study, the selection of text-books and other matters which cannot be conveniently and effectively dealt with by the Committee of Management."

These intentions were frustrated from the start by reason of the defective constitution framed for the council, which, for all practical purposes, reduced it to a nullity.

The fact that the management of educational matters at Roorkee was unsatisfactory received further confirmation in 1905 when a discussion took place in the Allahabad Senate upon the question of the abolition of the Faculty of Engineering. It was then stated* that—

"The College of Engineering at Roorkee is not what such an institution should be. Roorkee College, as an educational institution, is very far from being satisfactory, and the responsibility for this rests upon the Government. It is mainly officered by Royal Engineers who have had no special training for their work. Until this College is thoroughly reformed and its work put upon a sound educational basis, we, as a University, ought to refuse to give it recognition and hence to decline to establish a Faculty of Engineering."

3,762. *Failure of technical class due to neglect of educational details and inability to appreciate the value of educational experience.*—Moreover, the subsequent history of the College, since 1905, shows that there has been no improvement in this vitally important matter. In 1906 the Government, United Provinces, made a further endeavour to develop high grade technological work at Roorkee and, with this object in view, a technical class was started at Thomason College in October 1906 in accordance with a scheme outlined in Resolution No. 501 of 1906, Education Department, United Provinces.

This resolution shows that the object of the technical class was to provide a higher grade of training than that available in the mechanical apprentice class, but the ideas of those responsible for the scheme were very vague and confused, completely lacking the definition necessary to launch such a project with success. Students, however, were collected before any clear scheme had been formulated and before the teaching staff had been in any way notified of the extra duties expected from them. Shortly after the class started, proposals for the arrangement of systematic courses of instruction were brought forward by the educational staff, but these were all ruled out as inopportune, and the Principal was satisfied to allow the new students to work side by side with the mechanical apprentice class.

3,763. *Recommendations of Colvin scheme of reorganization only nominally carried into effect.*—The full history of this class is given in the Annexure A, prepared by the Thomason College Board of Studies, which came unofficially into existence owing to the educational difficulties which arose in connection with this same class. The whole case exhibits very clearly how those responsible for the management of the College were entirely unable to recognise the educational difficulties connected with the work and the value of educational experience in determining possible solutions of such difficulties. In the space of ten years (1906-16) these same classes were started abolished and restarted on three distinct occasions at Roorkee, the only difference introduced being merely one of name. Moreover during this very period, in 1909, the college was in reality transferred from the Education Department and placed under the Industries Department, the budget alone being left with the Education Department. The treatment accorded to the technical class was, unfortunately, of such a kind as to warrant the outside public in assuming that there was an attempt to stifle high grade technical education at Thomason Col-

* Vide Proceedings of Allahabad University Senate Meeting held 14th January 1905.

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lege. The responsibility for this, however, rested not with the educational authorities, but with those in administrative charge, who failed to realise the necessity for consulting the educational staff when seeking to solve educational difficulties.

3,764. *Non-educational system of control at Thomason College left unaltered.*—Although Thomason College was nominally transferred from Public Works control and placed under the Education Department in 1893, the original system of control has continued to persist up to the present time. Thus government deals with the college through the Committee of Management, the president of which is the Chief Engineer, Public Works Department, Buildings and Roads Branch, and who is likewise Secretary to Government in the Public Works Department. Education is represented on the Committee of Management by the Director of Public Instruction, through whose department all correspondence relative to the college should pass, if the college were really under educational control. This educational safeguard, however, no longer exists since, as mentioned above, the College, with the exception of its budget, has been placed under the Industries Department from 1909.

Moreover the final educational safeguard introduced in 1893 by affiliation with the Allahabad University and the creation of a Faculty of Engineering is non-existent, owing to the abolition of this Faculty in 1905. Consequently, so far as government is concerned, the College is under the joint control of the Public Works and Industries Departments, and educational influence can only be exerted through indirect channels.

3,765. *The system contrasted with that adopted at Medical College, Lucknow.*—The procedure adopted at another professional college is in distinct contrast with the case of Thomason College. The affiliation of the Medical College, Lucknow, to the Allahabad University, was accompanied by the creation of a Medical Faculty consisting very largely of members of the teaching staff of the College. In the case of Roorkee no member of the teaching staff was ever placed on the Faculty of Engineering, and owing to this circumstance that Faculty died of inanition. Through the Medical Faculty, which, as constituted, is an active reality, a measure of educational control exists at the Medical College; at Roorkee this has never been the case.

3,766. *Government's dissatisfaction with Thomason College.*—Finally with respect to the courses of training existing at Thomason College it is stated in paragraph 6 of G. O. No. 2365 (under reference above) that—

"It is in the judgment of the Lieutenant-Governor imperative that there should be at Roorkee, at the present juncture, a Principal who can tell from the practical experience of working with Roorkee men, what are the defects in the course or what are the conditions which are responsible for the unquestionable deterioration in the product of the College."

3,767. *Importance of educational questions raised.*—In view of the evidence already given in this Minute, it is respectfully submitted that in any examination of the questions raised by this statement from the local Government, the unofficial Board of Studies of Thomason College should be allowed full opportunity of presenting their opinions for the consideration of any duly appointed investigating authority. Educational questions of no inconsiderable importance are raised under such an inquiry, and unless educational officers be given full opportunity for presenting their side of the issue, there will be distinct danger of their being held responsible for certain undoubted defects which exist in the courses at Roorkee, for the presence of which, however, these officers are in no way answerable.

3,768. *Misleading statements current in India regarding unsuitability of educational officers for duty at technical institutions.*—Untenable statements have already been made on high authority in India regarding the unsuitability of educational officers for duty at technical institutions. Thus Sir Edward Buck, in his report on "Practical and Technical Education," dated 1901, stated that—

"Educational officers, however, able and accomplished they may be, have themselves had no practical

training, are not brought by their profession into contact with industrial occupations, have no technical knowledge."

This statement is very misleading, since it entirely fails to discriminate between educational officers brought out for purely scholastic work, and those recruited specially for service at technical institutions. All four educational officers at Roorkee, for instance, were possessed of, and selected for, their previous technical training before coming to India. The conclusions of Sir Edward Buck have produced a settled conviction in India that technical education must be divorced from general education and placed under entirely distinct control. This overlooks the fact that those technical institutions, which have done most for industrial development in Western countries, have been institutions in charge of educationalists possessed of technical training and experience.

3,769. *Improvements introduced at Thomason College by such officers.*—At Roorkee, since the appointment of Indian Educational Service officers to the staff, certain gradual changes have been inaugurated which have all tended to bring the courses at Thomason College more into line with those at Western engineering schools. Regular courses of lectures have been introduced, the work has been arranged in well-defined groups, an informal Board of Studies has been brought into existence, which has already justified itself by drawing up a scheme for the affiliation of the College to the Allahabad University, and which has received the approval of the Committee of Management of which the vice-chancellor of the University was a co-opted member at the time. In accordance with opinions promulgated by educational members of the staff, much of the low grade work, previously existing at Roorkee, has by government order been removed to more suitable centres.

3,770. *Insecurity of educational position.*—At the same time the educational position is insecure, in view of the evidence already given; and schemes for educational changes at Thomason College can still be initiated and accepted without the educational complexities involved ever being properly considered. This has occurred in recent years with disastrous results on three distinct occasions in the case of the technical classes (*vide Annexure A*). It seems likely to occur in the case of the civil engineering class for the following reasons.

3,771. *Nature of government's dissatisfaction with Thomason College and its causes.*—The dissatisfaction, felt in the Public Works Department with the products of this class, usually takes the form of an accusation that the students are unpractical when sent out on works. Such failure can only be due to two causes—(1) unsuitably arranged courses in civil engineering; (2) unsuitably arranged apprenticeships.

With regard to the first it may be noted that the courses in civil engineering are the only existing courses at the College which have never been modernised under educational direction. They belong to that group of studies which has never been placed, at Thomason College, under the control of an engineer with educational experience, as is the custom at Western engineering schools.

3,772. *Remedy lies in (1). Educational control.*—The civil engineering courses are unduly cumbered with subjects which are of little educational value for engineers, but which are possibly calculated to add to the immediate utility of the student in routine matters when he first goes on apprenticeship to the Public Works Department. This especially applies to estimating and accounts, and in a minor degree to drawing and surveying. It may be noted that this is an exact repetition of the conditions which prevailed at Cooper's Hill (*vide* paragraph 23 Report of Final Commission and Minutes of Evidence).

Such so-called practical subjects are apt to gain undue prominence in professional courses of instruction when these are arranged under the control of the department which is required to make use of the professional product so trained. Practical experience on works is not in itself a sufficient qualification for the discharge of duties connected with the educational management of a technical institution. Such experience is too apt to lose

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sight of the fact that it cannot itself be acquired at any college, it can only be gained on professional work. No technical college, however efficient, can turn out the finished professional product; the college course must be followed by a genuine period of apprenticeship. The advantage of the college training lies in the fact that it enables the recipient to acquire sound practical experience on works more rapidly than is otherwise possible. This advantage, however, only exists when the college training has been genuinely educative, i.e., concerned with the explanatory treatment of questions of scientific principle underlying the practice of the profession, and not with the mere memorising of items of professional routine. Confirmatory evidence on these points is forthcoming in the opening address delivered by Dr. W. C. Unwin, an acknowledged authority on the subject, at the conference convened by the Institute of Civil Engineers on the 29th June 1911 for the discussion of certain details connected with the education and training of engineers.

3,773. (2). *Properly arranged system of apprenticeships.*—With reference to the second point—suitable apprenticeships—there has undoubtedly existed in the Public Works Department a tendency to compare the Roorkee-trained student with the imported imperial service engineer, during the first year of service. This is obviously unfair to the Roorkee man, who, during his first year, is undergoing his apprenticeship and must therefore, in fairness, be regarded as still in *statu pupillari* whereas the imperial engineer is supposed, on appointment, to have already had a certain minimum of practical experience on engineering works.

One further point worthy of consideration in this connection is the introduction of the provincial service system and the consequent degradation of the status of Roorkee College. This has naturally compelled all who seek employment in the Public Works Department to prefer the worst engineering school in Britain to the best that can possibly be provided in India.

These are the points of educational importance which my experience at home and in India compel me to submit for careful and impartial investigation. This Minute has, therefore, been prepared for the purpose of bringing these matters forward for the consideration of the Public Works Department Reorganization Committee, which, under item VII of the terms of reference, is required to investigate—

“Whether the system of education in Government Engineering Colleges is organized on a sufficiently broad basis.

ANNEXURE A.

Note on the technical classes at Thomason College, prepared by the Board of Studies in connection with the new class started in October 1915.

In 1905, during the regime of Sir J. Digges la Touche,

REFERENCES.
No. 502, dated 1st September 1905, from Secy. to Govt. of India (Home Dept.) to Secy. to Govt., United Provinces.

Resolution Id. Dept., U.P., No. 501 of XV—413-54 of 1906.

correspondence passed between the local Government and the Government of India, with the object of starting a technical class at Roorkee. This new class was to provide training in mechanical and electrical engineering, and also in applied chemistry, for which government had every reason to consider that there was a real demand. In the correspondence referred to it is clearly indicated that the instruction, for which provision was about to be made, was to be of such a standard as ultimately to fit men for positions of responsibility on works, or in engineering establishments; and, so far as electrical engineering was concerned, definite mention was made regarding the openings likely to be available for well trained men in connection with the electric power installation in Cawnpore, and also the electric power schemes then under consideration for Lucknow and Allahabad, to which Mussoorie and Naini Tal might also have been added.

A perusal of Resolution No. 501 of 1906, conveying sanction for the establishment of this new class, shows beyond doubt that it was intended that the instruction to be given was to be of a distinctly higher standard than that already provided for in the existing mechanical apprentice class.

Unfortunately, in the correspondence cited above, the terms foremen, supervisors and overseers are confused with managers and investigators, and this clearly evidences that the precise nature of the training necessary for foremen and managers was not at all understood by those responsible for the launching of the new scheme. It was not understood, for instance, that foremen are simply reliable mechanics, with ability to control their fellow workmen, in their own particular line of trade; whereas the managers of engineering establishments are men of higher educational and professional attainment. It was the failure to comprehend this important educational detail, until it was too late, that led directly to the failure of this first scheme.

The first technical class opened at Roorkee in October 1906, with 35 students, but government fixed 30 as the number to be admitted in each subsequent year. The new class contained many promising candidates, but considerable diversity in educational qualifications existed among the students at entrance. This was due mainly to the fact that admission to the class was through nominations made by the Commissioners of the different divisions. This difficulty could, however, have been easily overcome, either by a more careful system of nomination, or by the institution of an entrance examination.

The next step of importance in connection with this class took place on the 3rd of April 1907—some six months after it had been at work—when at a meeting of the College Council, held on that date, proposals were put forward by certain members of the professorial staff, responsible for the actual teaching work, for making proper arrangements for systematic courses of instruction, but all the proposals then submitted were ruled out as inopportune. From its commencement the technical class worked side by side with, and on exactly the same lines as, the mechanical apprentices. Trouble, however, only arose when the technical class students reached their 3rd year, and then discovered definitely for themselves that the entire course was precisely the same as that laid down for the mechanical apprentices. Deputations from the 70 odd students then on the rolls waited on the members of the professorial staff, and feeling ran very high, owing to the fact that the students considered that they had been deceived; they had come to the College expecting to be trained in the higher branches of certain professions, and instead, they had been trained simply as mere mechanics. The dissatisfaction was great, and it was only by sympathetic and tactful dealing with the situation that unpleasant consequences were averted. Hurried arrangements had to be made for courses in science for all three years simultaneously, and such arrangements taxed both the resources of the College, and the teaching staff concerned.

The 3rd year students were invited back for a 4th year. Subsequently, questions were asked in Parliament, bearing upon the unsatisfactory character of the instruction provided, e.g., Sir J. D. Rees asked the Secretary of State for India (*Pioneer*, 12th April 1908)—

“Whether in view of the fact that the education supplied at modern Engineering Colleges is of a complex character, requiring a carefully prepared curriculum of a highly specialised nature, and that the Technical Classes started at Thomason College, Roorkee, under Resolution No. 501 of 1906, and published in the United Provinces Government Gazette, were intended to educate men for subsequent positions as managers of factories, the Government of India approves the Resolution of the Government of the United Provinces in which it is stated that there will be no out-and-dried curriculum;

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and whether the Secretary of State will cause inquiries to be made for the purpose of ascertaining whether the educational scheme characterised by the absence of a cut-and-dried curriculum is giving satisfactory results."

As the result of all the dissatisfaction which occurred in connection with the new technical class the then Lieutenant-Governor, Sir J. P. Hewett, visited Roorkee and met the members of the Committee of Management, when it was decided that the class should be immediately abolished. The reasons assigned for the failure of this class were

No. 601, Ind. Dept. dated 29th March 1909, vide file No. 62, Ind. Dept. Proceedings 132-133 of 1909.

(1) that it had been started prematurely, (2) that much confusion existed as to its real objects. This latter point is of extreme importance, and, moreover, its significance was clearly recognised by government, since, in order to make it quite clear it was stated in paragraph 2 of letter No. 601, dealing with the question, that—

"The Lieutenant-Governor, Sir J. P. Hewett, is of opinion that it is quite wrong in placing foremen, supervisors or overseers on the same plane as managers and investigators. If the ordinary workman is compared to a private soldier the foreman who is substantially of the same class, is a non-commissioned officer. The workman is provided for in Industrial Schools, the foreman in your Mechanical Apprentice class; perhaps that class, or some portions of it, may subsequently be transferred to Industrial Schools, but that is a separate question. The Technological Institute is to be the Industrial Sandhurst, and its object is to train the officer class of the industrial army, the men who by status, education, or possession of capital, are fitted to be leaders."

Particular attention should be directed to that portion of the quotation which is in italics, since the fact that the technical class was for the training of men of education and satisfactory status was subsequently entirely overlooked, and the sole view taken was that the only possible means of making the class a success was to fill it with sons of capitalists.

As a result of the first technical class failed, a Board of Studies, consisting of the professorial staff as members, first came into existence. It held its first meeting on the 8th of December, 1908, when proposals for a new technical class were formulated. These proposals were approved by the College Committee of Management, and government sanctioned the starting of a second technical class in October, 1909, termed the Higher Division of the Department of Technology, the mechanical apprentice class constituting the Lower Division.

In view of the dissatisfaction which occurred in connection with the first technical class, it was not surprising that only a few candidates offered themselves for admission to the Higher Division of the Department of Technology. Nevertheless, a few men of the right type were forthcoming, and among them were several Europeans, which fact could not be regarded as a drawback, since, if the Europeans were able to obtain substantial appointments at the end of their course, then the Indians would very soon compete for entrance to the class. Two students succeeded in completing satisfactorily the prescribed three years' course, and these—Mr. Thiek and Ghulam Muhammad, both obtained the Final or Honour's certificate in mechanical engineering at the examination held by the City and Guilds of London Institute. In the following year, 1911, Mr. Capstick did likewise. Now, these examinations represent a high degree of professional attainment, and no difficulty has been found in securing suitable employment for all the men turned out from this class, whose professional qualifications are equal to those of any home-trained engineers. From the very outset, however, the second technical class, called the Higher Division of the Department of Technology, did not, in the opinion of the professorial staff, receive the encouragement it deserved. It was pronounced a failure, nominally on the ground that the sons of capitalists were not forthcoming in considerable num-

bers to be enrolled as students, thus entirely overlooking the fact that the class was equally designed for the needs of men possessing the necessary status and educational attainment. The actual teaching staff considered the results of the Higher Division of the Department of Technology highly encouraging, and are fully convinced that a little sympathetic treatment on the part of the authorities, e.g., advertising in the papers and posting of circulars to schools, etc., was all that was necessary in order to render it a success. Moreover, in the circumstances, it was far better to start with a small number of students of the right type, for whom suitable openings could be found, than to secure large numbers of unsuitable men for whom no employment would be obtainable. Most of the larger and well known institutions in the West commenced work with very few students; for instance, the Mechanical Engineering Department in the Manchester School of Technology had only two students during the first year of its formation. It is found that the number of students rapidly increased as soon as an institution has established a reputation for turning out men of a high standard of professional efficiency, who are soon able to secure remunerative employment. For this reason it is an advantage to start with a few students of the right type, and it is seldom that the men thus available are the sons of capitalists.

Government has now sanctioned the starting of a 2nd technical class for the training of what is to be known as the "Improver Grade" of engineer, and some nine students joined the class for the first time at the commencement of the session in October 1915.

The advisability of such a start was considered at the first meeting of the Board of Industries held in Lucknow on the 5th December 1914, when it was resolved "that the Board is of opinion that a class of the 'Improver' grade is necessary and should be established. They consider that it cannot be satisfactorily carried out at the Technical Schools and that the Roorkee College appears to be the only possible place. It is, however, essential for the success of any such class that there should be a continuity of policy for a considerable term of years."

In order to render such continuity of policy possible, it is in the opinion of the Board of Studies advisable to define the character of the policy somewhat more clearly than has been done in the brief resolution accepted by the Board of Industries, and to emphasize certain features which should be regarded as essential in any type of technical work undertaken at Roorkee. The past history and official records of the technical classes at Roorkee render such definition and emphasis by no means difficult.

Since the Naini Tal conference of 1907, the general tendency of government policy in relation to technical education, so far as Thomason College is concerned, has been to remove from the College all lower grade work and transfer it to other centres scattered throughout the provinces, e.g., industrial classes in carpentry, wood-carving, fitting, etc., motor driver class, and finally the mechanical apprentice class. It is apparently recognised that the staff and equipment which have been provided at the Thomason College, at no inconsiderable cost, are specially adapted for higher grade technical education and that it is educationally unsound to concentrate both higher and lower grades at the same institution. This view is very fully elaborated in letter No. 601, Industries Department, dated 29th March 1909, from which an extract has already been quoted. Under these circumstances it is, in the opinion of the Board of Studies, insufficient to define the character of the new technical class as merely the "Improver" grade, and that this is so is shown from the fact that in certain semi-official correspondence government has already found it necessary to emphasize the fact that there is to be a "distinct cleavage between the new class and the

D. O. Ind. Dept., No. 174-C, dated 27th April 1915, a second letter was despatched shortly after.

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[Continued.]

mechanical apprentice class." Moreover, the need for a fuller definition of the "Improver" grade to avoid ambiguity, and to differentiate between this type of education and that provided for the old mechanical apprentice class, is also indicated in government resolution No. 1103, paragraph 13, where it is stated that "it is not altogether a complete analogy to treat the 'improver' class as parallel to the upper subordinate grade in the Public Works Department." From an educational stand-point this at once means that the type of education to be given in the new class is identical with that which the Board of Studies has already twice laid down for the two previous classes which have been abolished, and indicates that such abolition was in itself an unnecessarily drastic step. Continuity of policy can, in the opinion of

U. P. Govt. Resolu-
tion, Ind. Dept.
No. 1031
XXIII-416 dated
27th August.

1103, paragraph 13, where it is stated that "it is not altogether a complete analogy to treat the 'improver' class as parallel to the upper subordinate grade in the Public Works Department."

the Board of Studies, be very easily attained by emphasizing the position already clearly stated by government in letter No. 601, quoted above, and allowing a fair uninterrupted trial of the courses of instruction which the Board of Studies has always considered suitable in this connection. Minor changes, which experience may show to be necessary, can be introduced by alteration of the circular, so far as the constitution of the class is concerned; and, so far as the courses of instruction are concerned, by any changes approved by the Board of Studies, the body to which such matters were delegated by government when the original College Council was formed from which the Board of Studies has sprung as a sub-committee.

P. P. PHILLIPS.

Secretary.

E. F. TITTLE,

Dated 15th December 1916. Offg. Principal, President.

Mr. E. F. TITTLE called and examined.

3,774. (President.) The witness stated that he was the Professor of Mathematics at the Roorkee College, and that he had held that appointment for 20 years. He was a member of the Indian Educational Service and had been recruited specially for his present post.

3,775. The civil engineering course at the Roorkee College had been framed with the object of producing engineers for the provincial service of the Public Works Department. In addition to this course there were upper and lower subordinate courses, each of two years' duration, from which the upper and lower subordinates of the Public Works Department were recruited. The Roorkee College had also a textile section, an industrial section, a press section and a technical class, which last the witness thought would in future be known as the mechanical and electrical engineering class.

3,776. The age-limits fixed for admission to the civil engineering class were, he thought, 17 to 21, about 20 students being admitted each year as the result of a competitive examination. The total strength of this class was hence between 50 and 60. He did not know the maximum age-limit that had been fixed for admission to either the upper or lower subordinate classes, but believed that no limit had been fixed for the latter. His work was practically entirely restricted to the civil engineering class, and though responsible for the outline of the mathematical courses throughout the college he had not had much personal experience of the lower subordinate class: he was consequently not able to state what educational qualifications were required of students before admission to the latter.

3,777. The Roorkee College was a government institution, under a Committee of Management, of which the Chief Engineer in the Buildings and Roads Branch of the United Provinces Public Works Department was the president, the principal of the college the Secretary, and the local Director of Public Instruction and usually two railway engineers from the Oudh and Rohilkhand Railway, and Doctor Zia-ud-din, the Professor of mathematics at Aligarh, were members. In addition Doctor Sunder Lal, the late vice-chancellor of the Allahabad University, was a co-opted member. This constitution had been introduced when it was decided to make the Committee a sub-committee of the Board of Industries. The Roorkee College had also a Board of Studies, consisting of the principal and the professorial members of the staff. It was, he remarked, the college Council and not this Board of Studies that he had referred to in his written evidence as a "nullity." The college Council had been instituted in 1901 and consisted of certain members of the teaching staff of the college who were associated with the principal with the object of regulating the course of studies and the selection of text-books and other matters which could not be attended to by the Committee of Management. The present Board of Studies had been formed out of the college Council when the latter lapsed, and was an informal body, which had no defined functions, but only met when called together by the principal when that officer desired its assistance or advice. If members of the Board wished certain matters to be discussed they placed

the subjects before the Board's Secretary, who in turn referred them to the principal, and the latter decided whether to convene a meeting of the Board or not. The witness thought that the Board of Studies ought to be officially constituted and recognised by government, as, in his opinion, the present arrangement was unsuitable. The formation of a Board of Studies for the discussion of educational questions had never been demanded by government; the Board, which originated with the failure of the first technical class, was entirely informal and had been originally designed for the purpose of formulating a workable scheme for a technical class. He explained that the question whether the Board of Studies met frequently or not depended entirely on the attitude adopted by the principal. He drew attention to the written statement submitted by Mr. Jordan where, he thought, mention was made of a case connected with the third technical class in which an alteration in the curriculum had been made without reference to the Board of Studies, and added that his own curriculum had also been very largely reduced, the Board being merely instructed to modify the course in the manner suggested to them. He recommended that the Board of Studies should be definitely recognised by government as the body competent to deal with the internal affairs of the college, in the same manner as similar bodies were constituted and recognised in England. The result of such a course would be that no alterations in the curricula of the college could be made without reference to the Board, with the present constitution of which body he was satisfied.

3,778. In substitution for the Committee of Management he suggested a Board of Visitors who would visit the college and suggest, through the Director of Public Instruction, such modifications in regard to the management of the institution and the college courses as they might think desirable. Such changes as might be suggested in this way should, however, before being accepted and given effect to, be submitted for opinion to the college authorities.

3,779. The Roorkee College, though nominally an educational institution, was not controlled by the Director of Public Instruction, but by the Industries Department of the local Government, inasmuch as practically all correspondence between government and the college passed through that department. He believed that this change was instituted in 1909, but he only came to know of it personally when, at about that time, he submitted an application for leave and found that it had been dealt with in the Industries Department and not by the Director of Public Instruction. Again, while acting as principal of the college on two occasions, he had noticed that most of the correspondence with government was addressed to the Secretary to Government, Industries Department. He recommended that the college should be placed definitely under the Director of Public Instruction as was the Secretary of State's intention when sanctioning its transfer from the Public Works Department in 1893.

3,780. The Roorkee College had been affiliated to the local University in 1894, but this affiliation was no longer

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[Continued.]

in force and he recommended that it should be re-affiliated. The remark in his written evidence to the effect that the Faculty "had died of inanition" referred, he explained, to the Engineering Faculty constituted at that time. In his opinion affiliation would be advantageous in that it would bring the college into touch with other educational institutions in the province, Roorkee being at present isolated from the general scheme of education that had been framed for the United Provinces. He pointed out that the Medical College, which was affiliated to the University, accepted students with the intermediate standard of general education, whereas Roorkee admitted only graduates, and considered that it would be advantageous if engineering students were allowed to appear for the entrance examination into Roorkee after attaining the intermediate standard. In support of this contention he mentioned that certain students at present at Roorkee complained that much of their time was wasted on instruction covering the same ground in the subjects in which they had been required to qualify for their degree. The suggestion that the intermediate standard might be substituted for the present arrangement had been submitted several times to government but rejected, and he considered that affiliation to the University would make admission at this standard practicable since engineers turned out by the college would possess the B. E. degree, which he presumed would be considered sufficient to entitle them to enter government service. The whole question was, he stated, involved in some way with the rules for admission into government service.

3,781. He was of opinion that the advantage which at present accrued to colleges in England from affiliation to Universities, i.e., that the outlook of the students was widened thereby, would follow in the case of the Roorkee College if affiliated to the Allahabad University. He also felt that with affiliation the college would secure a greater degree of educational control than it possessed at present, and that the University, which was at present deficient as regards its technical side, would benefit from the change.

3,782. The whole question of whether affiliation would or would not be useful depended, he stated, on the constitution of a proper Faculty of Engineering. This point, he added, had been formerly discussed, and while he admitted that, in the case of the Allahabad University, there was no safeguard against the appointment to such a Faculty of individuals devoid of a knowledge of engineering education, he questioned whether steps could not be taken to improve the situation. He expressed himself as unable to understand the contentions that affiliation might lead to undue interference from the University, more particularly in connection with science subjects, e.g., physics, chemistry and mechanics, or that the standards fixed by the University might be higher than was essential to a good engineering education. Engineering, he remarked, was an applied science and based fundamentally on pure science, and any standards that might be fixed could not be unduly high, provided that at the same time students were shown the application of scientific principles to engineering works. The safeguard against an unduly high standard in pure science, which might encroach on subjects of a specific engineering character was, he remarked, the constitution of a proper Faculty of Engineering together with affiliation.

3,783. He was not aware that, in the case of English engineering colleges, the Universities took into account the practical apprenticeship test through which students passed after the theoretical course; he was not familiar with any English college doing this. He had, however, noticed in newspapers a statement to the effect that it would be better if engineering degrees were bestowed more on the line of the A.M.I.C.E.—an examination conducted by a professional body of engineers, which, merely as an examining body and not as a teaching body, had laid down a certain standard of professional attainment and declined to give its *imprimatur* to any individual who had not attained that standard of theoretical knowledge in combination with a certain amount of practical training. While in the case of English engineering col-

leges arrangements might be made for students to go through apprenticeships under the sandwich system or at the end of the college course, he was not aware of any case in which the University authorities took reports on the result of such apprenticeship work into consideration when awarding an engineering degree. He approved of the suggestion that such a degree might be withheld until, in addition to the theoretical course, a student had been through a course of practical training and had received a certificate to the effect that such practical work had been satisfactorily performed, but he was not able to state whether such a system could be secured with affiliation or not.

3,784. The fact that Roorkee at present provided a certain amount of low-grade technical instruction tended, in his opinion, to degrade the tone of that college, and it would, he thought, be better from the point of view of the engineering class to remove the textile class and also certain other low-grade sections from the college. Personally he considered it unsound to attempt to combine a higher and a lower grade of education in the same institution. He accordingly favoured the abolition of the lower subordinate class from Roorkee, and observed that such a class could be suitably provided for in industrial schools. He felt that the existing arrangement not only lowered the tone of the college, but created considerable difficulties in the way of running such an institution. He stated, by way of example, that privileges such as the use of the library, that might be accorded to the engineering class students, could not be extended to lower subordinates without risk of abuse. He stated, moreover, that the three classes of civil engineers, upper subordinates and lower subordinates, were kept absolutely distinct and under three separate staffs and that no two of them attended a common course of lectures. He was not prepared personally to recommend the removal of the upper subordinate class also, but remarked that it was quite open to discussion whether upper subordinates would not be in a better position as the highest class in industrial schools rather than as the lowest class in engineering colleges.

3,785. The curriculum of studies followed at Roorkee was, he stated, in some respects unsuitable, since it had been framed more to meet the needs of the Public Works Department subordinate than to impart a thoroughly good engineering education. The courses in estimating and accounts were, he considered, too elaborate, since estimating, after all, was hardly a subject that need find a separate place in an engineer's course. It was merely a routine attainment, which could be secured by ability to read a plan, a certain amount of knowledge of mensuration and a knowledge of rates. He surmised that accounts instruction was imparted in order to familiarize students with Public Works Department forms.

3,786. He considered that a better standard of education in engineering might be attained if the engineering courses at Roorkee were organized more on the lines adopted in England, i.e., if more time were allotted to engineering design and less importance attached to instruction in surveying. In his opinion engineers ought after their college course to acquire their detailed knowledge of surveying by practical experience, and need only be made familiar with the principles of survey work during that course. It was not at all necessary to turn out, as was done at present, more or less practised surveyors.

3,787. Every student who passed out yearly from Roorkee from the engineering class did not, he remarked, enter the Public Works Department. The yearly outturn of engineers averaged about 20 and as there were only 7 guaranteed appointments the balance usually found work as temporary engineers and with municipalities, etc. Figures showing the number that entered the Public Works Department could, he mentioned, be compiled in the college office, where a register was maintained. He added that his knowledge as to the appointments which Roorkee engineers obtained had been gained during his experience as officiating principal of the college.

3,788. He confirmed the opinion put forward in his written evidence that practical instruction ought to be

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[Continued.]

given to students after their college course, and he based his contention that engineers turned out from Indian colleges, such as Roorkee, were not sufficiently trained in practical work on the lack of a suitable system of apprenticeship during which the apprentices might have to apply their theoretical knowledge to engineering problems. Failure in this respect could not, he thought, be attributed to insufficient workshop training of students while at college, and he was of opinion that more hours in the workshop and less at lectures would only turn out individuals of an efficient *mistri* type. In his opinion just as much workshop instruction was imparted at Roorkee as at Cambridge.

3,780. The names of passed engineers from the Roorkee College who were not selected to undertake a course of practical training in connection with the government guaranteed appointments were, he explained, placed on a register from which selections were made for appointments which the college was asked to fill, but no arrangements for a practical course of training were made on behalf of such men. The suggestion that arrangements might be made for furnishing practical training to all students turned out from Roorkee had previously been put before government by the Board of Studies, but government were unable to accept it at the time. Provided that a genuine apprenticeship was given to each engineer, he personally was in favour of the proposition, no matter whether engineers were trained under the agency of the Public Works Department, private firms, municipalities or port trusts.

3,790. Apprentices undergoing a practical course of training would, he stated, probably expect to receive stipends during the period in question. If a living wage were not paid them, they might be inclined to accept appointments that would not afford them as sound a practical training as that which government could arrange for. To the suggestion that it was usually the practice of students in England to pay premia for practical instruction, he replied that he understood that many firms in England accepted apprentices without premia if such individuals had been through a college course in preference to individuals who paid premia but had not been through such a course.

3,791. Practical training to be really complete ought, he considered, to provide for a period on construction works and another in a designing office, *e.g.*, if the length of the practical course was fixed at one year, six months during the working season might be spent on construction work, and the remainder of the period in a designing office.

3,792. He had inspected some nineteen engineering schools in Great Britain in 1905 and he did not think that the theoretical instruction afforded at the Roorkee College was actually up to the highest standard of instruction imparted in British institutions, though it might compare favourably with the ordinary English standard. He explained, however, that this opinion was based mainly on a comparison of the several mathematical courses of English colleges with that of Roorkee.

3,793. He did not think it altogether a waste of time that students at Roorkee were required to go through a course of instruction in subjects such as chemistry and physics, which they had already taken in qualifying for their degree, because such students did not possess a very firm mental grip of the subjects in question, and he thought that repetition considerably bettered their knowledge. He had found that students under instruction in mechanics were unable to solve problems which required the application of mechanics to the type of questions met with in engineering, and experienced considerable difficulty in arriving at correct solutions.

3,794. The suggestion that the age-limit for admission to Roorkee might be reduced so as to admit students with an intermediate science standard of general education which, he stated, had been recommended by the college Board of Studies, would, in his opinion, effect an improvement. He did not, however, agree with proposal that the age-limit should be reduced so as to permit students to enter the college at the school-leaving age, notwithstanding that a longer course of instruction in

engineering was imposed, considering that students with only a matriculation standard of general education required further general training especially in English.

3,795. The entrance examination for Roorkee required, to be entirely remodelled on the lines recommended by the college Board of Studies so as to ensure that only candidates likely to profit by an engineering course were selected.

3,796. In the case of the mechanical and electrical engineering class, instruction was given to students who were less highly educated than those who entered the civil engineering class, but certain lectures were common to both classes.

3,797. In his opinion the difficulty that would require to be overcome in introducing specialist courses, such as architecture, etc., into Indian engineering colleges was due to the fact that most of the students in the engineer class desired ultimately to secure Public Works Department appointments, and the question whether students would be induced to take up specialist courses or not depended on what guaranteed appointments of a specialist nature were available. He personally favoured a general civil engineering course followed by a genuine period of apprenticeship in some special branch, after which specialization would naturally follow.

3,798. The Roorkee College was in his opinion thoroughly well equipped, and so far as his own section was concerned he had no recommendations for improvement to put forward. If, as he had suggested, the lower subordinate class was transferred, there would be more college buildings available than the institution could utilise under existing conditions.

3,799. As regards the staff of the Roorkee College, he considered that a professor for civil engineering familiar with the way civil engineering courses were conducted in England was a long felt necessity, and also suggested that the civil engineering staff of the college might be somewhat strengthened by reorganization on the same lines as other departments of the college, *i.e.*, by provision for assistants, and demonstrators in addition to the professor in charge.

3,800. (*Mr. Cobb.*) There appeared to him to be considerable scope in India for the employment of engineers, as a considerable number of such individuals had at present to be imported; but he did not know whether it would be possible to obtain sufficient suitable material in India itself to fill all engineering appointments. In this connection he suggested that the Roorkee College ought to be reserved for higher grade work in technology and not burdened with lower grade classes. He admitted that there was at present a considerable demand for the subordinate product from Indian engineering colleges, but urged that students who wished to enter the lower grades of the Public Works Department should be trained at separate centres, where industrial schools for lower grade technical work had been established. The higher of the two subordinate grades might be founded on a standard of general education equivalent to that afforded by secondary schools and the lower on the primary school standard.

3,801. The class of students who entered Roorkee varied, he stated, considerably in social standing. A certain proportion, he thought, belonged to an influential class. The engineer class had attached to it three or four scholarships, none of which he thought exceeded Rs. 40. The expenses of an Indian student at Roorkee possibly amounted to between Rs. 70 and Rs. 80 a month and those of a European student to perhaps between Rs. 120 and Rs. 130. He had never worked out figures to show the amount that it cost government to train students, but remarked that the students did not by any means pay for the cost of the training they received.

3,802. Affiliation to the University was in his opinion sound from the educational stand-point, but the benefits to be derived depended on the proper constitution of the Engineering Faculty. He considered that once such a constitution was satisfactorily settled there should be no hesitation in advocating affiliation.

3,803. (*Rai Bahadur Ganga Ram.*) The Committee of Management for the Roorkee College was required to

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[Continued.]

meet, he thought, twice a year. He did not know whether the proceedings of each meeting, which were printed up, were subsequently published. The students had not access to such proceedings, because they were not kept in the library. A file of the proceedings was maintained in the principal's office, and though not labelled confidential it would not, he thought, be an advantage for the students to have access to it.

3,804. He explained that when he made the statement that the standard of instruction imparted at Roorkee was not equal to the highest standard imparted in colleges in England he had in mind more or less the mathematical knowledge possessed by men who passed out from Cambridge. A. M. I. C. E. candidates were not set separate papers in mathematics, and since certain engineers trained at Roorkee had secured that diploma, he considered that the standard of instruction at Roorkee was quite equal to that required for the A.M.I.C.E.

3,805. As he considered it to be disadvantageous for an educational institution to be isolated from all other similar institutions of the province, he had, he explained, recommended affiliation to the local University.

3,806. There had been cases in which European students had secured prize appointments, but of late years Indian graduates had invariably obtained the guaranteed posts.

3,807. Qualified men had not as yet been turned out from the mechanical and electrical engineering class of the college because the change in the designation of that class had only been effected in 1915. Two men had, however, passed out from the previous class, one of whom, Mr. Thick, was at present doing well on the Simla Hydro-Electric Scheme. No guaranteed appointments were allotted to this class.

3,808. A considerable number of the Roorkee College text-books had, he thought, been revised, but since there were now many good general text-books available he was not personally in favour of the maintenance of a special set for Roorkee.

3,809. (*Mr. Mackenzie.*) In connection with the statement made in his written evidence to the effect that the Faculty of Engineering created in 1894 (when the Roorkee College was affiliated to the Allahabad University) had been allowed to "die of inanition since government failed to realize the necessity for ensuring a sufficiency of Fellows competent to serve on such a Faculty," he said that that inanition was due to the fact that no attempt was apparently made to appoint suitably-qualified Fellows to the Faculty of Engineering. He believed that the vice-chancellor of the University allotted Fellows to the Faculties, but added that government were responsible for the nomination of a certain number of Fellows on the Senate, and in exercise of that responsibility might have nominated a certain number suitably qualified to serve on a Faculty of Engineering.

3,810. The recommendations of the Committee of Management of the Roorkee College were, he stated, submitted to government in the following manner. After the committee had held a meeting, and the minutes had been prepared by the principal and circulated to the members, the principal sent a copy to the Secretary to Government, Industries Department. The witness did not think that this Secretary could by any chance be identical with the Secretary for Education, and he was not able to state why the Industries Department in particular had been selected to deal with the Roorkee College. He suggested that Roorkee matters should be submitted through the Director of Public Instruction to the Educational Secretary to Government and that the Board of Studies should be given a definite official position in relation to the internal affairs of the college.

3,811. Affiliation to the local University would, he stated, prevent the Roorkee College from being an isolated institution, and this was one of the points considered by the Colvin Committee in 1891. That committee considered it a disadvantage that the Roorkee College was in no way part of the general educational system of the provinces. In spite of this fact, however, the college had

turned out a certain number of men whom the Public Works Department had found useful, and the training had on the whole improved, but he thought that it might be still further improved by being brought into touch with other institutions.

3,812. In connection with the Colvin Committee's proceedings, the Secretary of State had laid down that the Roorkee College should be constituted so as to impart a general engineering education to meet the industrial needs of the province. Hence it was not the intention of government to restrict the college to turning out engineers for government service only.

3,813. The European students had a separate mess of their own. A general recreation scheme had been framed for the civil engineer class as a whole, and while matches might be played between that class and subordinates these two classes ran separate clubs. The college team, however, was, he thought, a mixed one.

3,814. He reaffirmed his opinion that the teaching of surveying was of no great educational value to an engineer, and while admitting that instruction in that subject might cultivate precision pointed out that other things also, such as measurements in a laboratory, had the same effect. The question had been discussed in evidence before the Cooper's Hill Commission, and although precision might result from a training in surveying, Sir Alexander Rendall had stated that it was a low branch of the profession. Considering that it was quite possible for an engineer who knew a certain amount of mensuration, possessed a knowledge of rates, and was able to read a plan, to work out an estimate, he did not think that much special training was needed for estimating in the case of an educated engineering student. In his opinion instruction in estimating took a much more prominent place in engineering courses in India than was the case in England.

3,815. The engineering class at Roorkee, for which in his opinion additional workshop training was not required would, he considered, derive much advantage from the practical application of their theoretical knowledge during the term of their apprenticeship.

3,816. (*Mr. Willmott.*) The Faculty of Engineering which had been abolished in 1905 did not, he thought, accomplish anything. The principal of the college had been an *ex-officio* member, but the Roorkee professors were not represented on the Faculty, or Senate. Adverting to the statement that the reason for the failure of the Faculty was the dearth of suitably qualified men, he said that certain of the professorial members of the Roorkee staff might have been tried, and mentioned two others, besides himself, who had the necessary engineering educational training. In admitting that when the Faculty was constituted in 1894 there were no members of the Roorkee professorial staff who could have been appointed to it, he remarked that as far as his knowledge went the Roorkee professors were never subsequently placed in a position to serve on that Faculty. The fact that after affiliation to the University it would be necessary for members of the professorial staff to go backwards and forwards between Roorkee and Allahabad would not, he thought, entail any inconvenience on the staff since it did not inconvenience the staffs of other affiliated colleges in the province, and the meetings were not numerous.

3,817. The instructional staff of professors, assistant professors, etc., at Roorkee was, he considered, quite strong enough for the average number of civil engineering students usually under training. The civil engineering department, however, needed bringing into line with the scientific sections of the college.

3,818. (*President.*) The Roorkee College did not attract at the present time as good a class of student as it used to attract formerly. He personally had been at Roorkee for about 20 years, having been appointed shortly after the provincial system was started. He thought the present inferiority in the class of students was due to the alterations that were made at that time and which had adversely affected their prospects in life.

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MR. A. C. VERRIERES.

[Continued.]

At Allahabad, Friday, 30th March 1917.

PRESENT :

F. G. SLX, Esq., C.S.I., I.C.S. (President).

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member :—

The Hon'ble MR. H. M. WILLMOTT, F.C.I., A.M.I.C.E., Chief Engineer and Secretary to the Government of the United Provinces, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary).

A. C. VERRIERES, Esq., C.I.E., Superintending Engineer, Public Works Department.

Written Statement.

3,819. (Preamble.) The aims of the Committee are—

- (i) to substitute private for departmental agency in carrying out works;
- (ii) to make greater use of local bodies, some of which employ skilled public works agency;
- (iii) to carry out works on contract subject to government inspection;
- (iv) to encourage local bodies to employ their own staffs or to arrange for their works through private agencies;
- (v) to stimulate the growth of engineering firms of standing;
- (vi) to provide facilities for the best engineering training in engineering colleges.

(2). The custom in these provinces is to employ contractors for the execution of public works—practically no works are carried out by daily labour. When a work is sanctioned and funds allotted, tenders are called for by the ^{district engineer} ~~district surveyor~~ by public notice, and contractors are recommended by him. The Executive Engineer has powers to accept tenders up to Rs. 5,000, the Superintending Engineer up to Rs. 50,000. Beyond this amount tenders are accepted by the Chief Engineer.

(3). None of our Indian contractors are men with any technical training, nor do they, as far as I am aware, employ engineers. In certain large towns like Cawnpore and Allahabad there are, I believe, certain European firms of architects and builders which do employ more or less trained men, but they have never carried out any works for me and I know nothing about them. A certain firm in Lucknow too employ trained European engineers and carry out and design drainage and water schemes. They have never done any work for me.

(4). It may be said then, that all our Indian contractors are merely employers of labour and work directly under Public Works Department supervision. Indian firms of builders or architects or engineers practically do not exist.

(5). The system has brought into existence some excellent contractors—but contracting in the Public Works Department is apparently not a paying business and I can only recall a very few cases in which a business has been handed down from father to son. It may be said that our methods give rise to rapacity in our subordinates—but I am convinced that our subordinates are no worse than those of other departments and that the real reason why our contractors are not able to establish firms is that our rates are far too low for the quality of the work demanded. I would draw particular attention to this point as it seems to answer the charge of extravagance levelled against the Public Works Department by persons who, as often as not, are not competent to express an opinion. I maintain that no better evidence is needed to prove that greater economy is neither possible nor justifiable.

(6). There is a feeling abroad that our rates are considerably higher than those paid by private individuals—without wishing to deny that our rates may be somewhat higher, I would point out that the standard of work must also of necessity be higher.

(7). I have said before, that our subordinates are no more corrupt than those of other departments—by this I do not mean to suggest that there is no room for improvement. I have always maintained that a great deal of temptation is thrown in their way and I shall have something to say later as regards suggestions to remedy these defects.

(8). I am in agreement, in principle, with the idea of employing private agencies as far as possible for the design and execution of works—but I am not in favour of employing the same agency for both the design and execution of the same work on a percentage basis—such a measure would not lend itself to economy of design, because economy would mean a diminished income. I do not mean to say that firms could not be found that would honestly work in the best interests of their employers, but I do mean to say that the principle is wrong and should not be employed. Local bodies may, I consider, have the option of employing a firm of consulting engineers to design and supervise their works in place of a district engineer, but the actual work of construction should be carried out by contractors or firms of engineers.

(9). In only a very few centres could private firms of engineers be procurable that would be able to design and carry out works satisfactorily. For small districts, the works in which consist mainly of repairs to roads and scattered buildings, engineers would have to be employed by district boards to execute works through contractors just as is done at present. I have found that Indian contractors are seldom willing to carry out works outside their own districts, and indeed will frequently only take up works in certain areas.

(10). As regards the employment by district boards of their own staffs, I do not think that they will be able to recruit engineers of the right stamp at the outset as easily as they think. Competent engineers are not easy to secure in this country. I can understand the reason why engineers are not available from England on temporary agreements, but I have never been able to understand what happens to all the Indian college engineers who do not obtain government employment. The fact remains however that it is almost impossible to get really good men just now. This province has had some painful experiences with temporary engineers in the past; and if the Public Works Department could not manage them I question whether it would be possible for the district boards to get them to do their work satisfactorily. On this point however I expect the Committee will obtain first-hand information from Bengal and the Punjab where the system of district board engineers has been in force for years. The difficulties I write of are probably due to the fact that the recruitment of temporary engineers has so far never been made under any

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such system as seems to be contemplated for the future and it is more than probable that the market will improve with improved prospects.

(11). The Indian-trained engineer is, I think, well trained theoretically for general purposes. His practical training is the difficulty. The railways and irrigation works train their men well in their own special lines, but it takes a buildings and roads engineer longer to work up confidence in himself, because the number of large works upon which he is engaged in the first few years of his service is necessarily limited. He is of course encouraged to visit large works in course of construction, but the mere noting on works is not sufficient. He wants to be taught how to manage contractors and work-people and how to exercise tact and judgment, he must know exactly what he wants and when and where he wants it, he must exercise forethought and ingenuity. Unless he has large works immediately under his charge from the first his real training takes long. Now there is no help for this. His practical training, on which such a deal of stress is laid, is purely a matter of time. I shall have something to say on the subject of practical training for engineering students later, but what I would like to say at the present stage is that I consider that a year's practical training, though it is very useful, does not make an engineer. There are so many difficulties met with in actual construction of works that one year's practical experience will not teach a student how to overcome them. All that a year on works can do is to teach him how to manufacture ordinary materials and how to put them together. He may learn how a well is sunk or how a girder is erected, but there are heaps of other things to be learnt in engineering, and these he can only learn after years of experience of a varied character. Now I do not mean to throw cold water on the idea of a year's practical training, but there are other matters I would lay greater stress on. There are two fundamental considerations which, I consider, must be kept in mind in an engineer's education. Firstly there must be a close co-ordination between his theoretical ground-work and its application to practical design. He must not be allowed to consider the mathematical side of engineering a mere accomplishment to be learnt and then put aside. He must be given practical exercises in the design of structures of all kinds and must be taught how to apply his theory to practice. His instruction in engineering and applied mathematics must be arranged so as to work in with one another. Secondly, his training during apprenticeship must be as thorough as possible. His course of instruction must be left to the educational authorities, but I will try and explain my views on practical training in its proper place. With this preamble I will now take up the points raised for discussion before the Committee.

3,820. (L) Economy and suitability of methods of execution of public works.—I cannot for a moment admit that the methods employed at present are not economical on the whole. I do not say that works cannot be carried out more cheaply under better conditions, but I believe that with the material at our disposal at the moment, it is next to impossible. Further economy is not possible unless we are given a more reliable staff. I do not believe for a moment that the employment of private firms will result in further economy if our standards of work are to be maintained.

(2). I maintain, without fear of contradiction, that no contractor would find any profit in isolated works even if they were given to him at Public Works Department rates. To make it paying he must get the monopoly of all works big and small in a fairly large area. I do not think that the government would be willing to lay down as a principle that it is desirable to encourage a few contractors to the exclusion of all others. It might pay a firm of engineers to undertake the supervision of several works on a percentage basis, but it would not pay the individual contractor to carry them out singly. I consider that too much stress has been laid on the question of rates. Indeed, I am convinced that there is no money in isolated works even when percentage charges for supervision are thrown in. What a firm wants is a large

work and fairly concentrated. It wants work in its particular line.

(3). There has been some talk of executing work at ten per cent. below estimated Public Works Department rates. I maintain that such a thing is not possible nor desirable for small and isolated works—(and after all the Public Works Department must fix their schedule of rates to suit all kinds of work and in all localities), but it is possible to execute large works at less rates than the Public Works Department estimate. I may mention the Postmaster General's office at Lucknow as an excellent example of excellent work which was carried out by the Public Works Department at 13 per cent. less than estimated rates.

(4). Private firms will sub-let contracts and whatever happens there must be subordinates to measure and supervise. Quantity surveyors do not exist in this country and whether we have district board engineers or whether we have private firms a certain amount of leakage will take place. Now all or most of our subordinates are permanent government servants, and they know perfectly well that they have a great deal to lose if their services are dispensed with. We can, and do keep them in check as far as possible. It may be argued that it is preferable to employ temporary subordinates because they can be got rid of so easily. It certainly is very difficult, under present regulations, to get rid of bad bargains, but it is always possible to hold departmental inquiries, and to dispense with a man's services. I cannot believe that temporary subordinates will be better. All our experience goes to show that they will be considerably worse than our permanent men. The reason seems to be that permanent government service is much sought after and we are able to select men. Temporary district board engineers and temporary subordinates will not be an improvement; at least not for a very long time to come. I have always found that chairmen of district boards complain that they cannot get sub-overseers that suit them and I am not surprised. Whatever the Public Works Department is, it is an organised department, and one of its chief duties is to weed out bad bargains and to provide the best subordinates that the money can give. If a temporary engineer is employed by a district board the chairman is totally dependent on him, and if he be unreliable he (the chairman) will find it a pretty expensive matter.

(5). I do not wish it to be understood that I do not advocate the employment of district board engineers. All I wish to say is that they are not easily obtainable at present and that if changes are made they must be made very gradually. I wish to sound a note of warning, and to say that for the present our methods, though capable of improvement, are generally suitable.

(6). I very much doubt whether a suitable type of temporary subordinate will be obtainable for many years to come—traditions die hard, and it will take a long time to convince both engineers and subordinates that temporary service under district boards is as good as permanent service under government. The best men will try and obtain service in the irrigation and railway branches and the district boards and municipalities will get the leavings. I have touched on the question of staff because on it depends the question of rates to a great extent.

(7). I do not see why firms of standing should not be employed by district boards if they can be obtained, though I cannot believe that their employment will lead to further economy. I understand that they would act as consulting and supervising engineers to district boards, that the execution of works would not be in their hands, and that they would submit their schemes, above a certain amount, to the government for criticism; with this principle I have no fault to find. In fact I would be very glad to see some work taken off our hands. If however the idea is that they should both design and execute works then I say that the system cannot lead to further economy because expensive design will be to their advantage.

3,821. (II.) Encouragement of other agency.—Contractors are encouraged to apply for contracts for

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works, the estimates for which have been drawn up by the Public Works Department, but I cannot say that they are encouraged to submit designs, or to display originality or initiative. They are without exception merely employers of labour and carry out Public Works Department designs on Public Works Department specifications and under Public Works Department supervision. I have never known one to employ an engineer of his own. It is understood that the Public Works Department are responsible for the work and machinery, if required, is supplied by the Public Works Department. The labour only is the contractors'. They are not engineers and this being so I cannot see how they can be entrusted with the construction and upkeep of any but the most unimportant works. If however contractors of repute are willing to employ certificated engineers there seems to be no reason why they should not be employed as consulting and supervising engineers to district boards or municipalities. I do not think that the time has yet come to permit them to supervise works in which they have a personal interest. If they are to be employed as contractors, pure and simple, it does not pay them to employ engineers as the rates do not permit of outlay on expensive establishment, and there will be great difficulty in convincing them of the necessity of employing engineers when so far they have been able to get the services of the district engineer free. I see however that it is contemplated to give them the construction and upkeep of certain classes of works. This means, I fancy, that as a start works on which little or no engineering skill is needed, such as for instance the upkeep of metalled roads, the construction of small culverts and inspection houses, etc., might be made over to them. Of course this might be done, but I am perfectly convinced that there are very few contractors who could be trusted to carry out even these works with any show of success when once supervision is removed. After all the maintenance of a road is not such an easy matter as it appears. A culvert wants to be levelled and its proper site fixed. A bungalow wants a certain amount of finish. There are very few of us who have not seen culverts sticking up like fortifications above a road when there has been no reason for it. I for one have seen a culvert built on a watershed, where there was no possibility of it ever being any use whatever. This because the district surveyor left it to the contractor.

(2). I would not recommend works being made over to contractors for execution or upkeep, but the matter may be left to the discretion of the chairman of the district board. If he has faith in any contractor he might give him a trial. I take it that the district engineers would be relieved of all responsibility as regards the quality of the work turned out. I personally do not know the contractor whom I would entrust altogether with the execution or upkeep of any work and I consider it altogether a wrong principle to relieve him of perpetual supervision whether it be that of the Public Works Department or the district board consulting and supervising engineer or the district engineer.

(3). As regards encouragement I would divide contractors up into three classes. Class I would consist of men who have shown that they can carry out works up to Rs. 50,000 and over. They would be possessed of a certain amount of capital and have factories and workshops of their own—lime factories, brick kilns, carpenters' shops, blacksmiths' shops. They must have worked for the Public Works Department at least 20 years (this would ensure that they would be conversant with the ordinary principles of building construction). If these men are willing to employ engineers to make up simple designs and estimates they might be given a trial as district board engineers for designing and supervising works, or they might carry out works as ordinary contractors and in that case they need not employ engineers and would then work exactly under the same conditions as they do at present. Some system should be devised by which these men are kept continually supplied with work as far as possible. Class II should consist of contractors who can carry out and finance works from Rs. 10,000 to Rs. 50,000. Class III should consist of

petty contractors who can only carry out works up to Rs. 10,000. Contracts would be given out by Executive Engineers, Public Works, and other subordinates would have nothing to say in the matter. In other words the principle should be to make the contractor as far as possible responsible to the officers of the Department and to make the subordinate a mere overseer. This can only be done by reducing the size of divisional charges, bills should be prepared and paid by the Executive Engineer. To put it in a few words "in order to reduce speculation and give fair play reduce the powers of the subordinate."

3,822. (III.) Changes in organization.—I would like to say exactly how far I would be prepared to go and how far I would reorganize the Public Works Department in order to meet the suggestions put before me. The Buildings and Roads Branch of the Public Works Department in these provinces is composed, as it stands, of the Buildings and Roads and Sanitary Branches. The Consulting Architect advises the government when large building schemes are contemplated, the Electric Inspector advises on electrical schemes.

(2). The Sanitary Engineer has his own staff of engineers as distinct from those attached to the ordinary Buildings and Roads divisions, and advises on all works connected with drainage and water-supply. The Buildings and Roads Branch consists of four circles each under a Superintending Engineer. Each circle is divided into divisions under Executive Engineers and each division in turn is divided into districts under ^{district engineers} ~~district surveyors~~. The Chief Engineer controls the whole and he is assisted by a Personal Assistant who is also Under Secretary and is usually an Executive Engineer. Now I would like to see more "specialization" in the Public Works Department.

(3). I would like to see the Sanitary Branch separated from the Buildings and Roads Branch, i.e., I would like to see it with a Chief Engineer of its own. The expenditure on sanitary works is on the increase and it will go on increasing as time goes on. The Chief Sanitary Engineer would have a Deputy Chief Engineer where one is necessary and a staff of Executive and Assistant Engineers, and would have the Electric Inspector attached to his office—the whole forming a branch of municipal engineering.

(4). The Chief Engineer of the Buildings and Roads Branch would control the buildings and roads and bridges branch. He would have the Consulting Architect attached to his office. He would have a technical branch under a Deputy Chief Engineer and designs for works above a certain sum in value would be vetted or designed in his office. I would like to emphasize the necessity for a technical branch, because not only would it accelerate business, but it would enable us to give apprentices an excellent education in practical design as I will try and explain later. I would like to have the Superintending Engineers attached to the Chief Engineer's office. They would be called Deputy Chief Engineers for construction and would be in constant touch with the Chief Engineer. They would have only camp offices. I would abolish the Personal Assistant and give the Chief Engineer an Under Secretary for the Secretariat work only. Cases would be dealt with by the Superintending Engineer directly in consultation with the Chief Engineer and he (the Superintending Engineer) should be relieved of as much routine work as possible. At present his individuality is crushed out of him by the amount of office work he has to do. The Superintending Engineers would have circles just as at present and headquarters at Lucknow, Meerut and Allahabad. Now I do not think the time has come to go to the open market for district engineers and I do not recommend hasty changes, but to meet the wishes of the government, viz., the encouragement of private enterprise and the establishment of a market for the employment of the Indian-trained engineers, I would go so far as to aim at placing all local works under the control of the chairman of the district board eventually. He might employ any agency he pleases for their execution and maintenance. He might

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have a district board engineer, or he might employ a firm of consulting engineers. These agencies might carry out works up to certain limits fixed by the government, on the sanction of the Commissioner. Works of greater magnitude would have to receive the sanction of the government. For large works the board would have the option of choosing the agency through which they would be executed, viz., either the Public Works Department or their own agency. The Superintending Engineer of the circle would exercise a general supervision over district board works.

(5). Generally I would place all provincial works under the Public Works Department but there are several districts which contain no provincial works of any importance, such for instance as a few miles of provincial road, a *kutcherri*, a judge's court, a dispensary, etc. These works should be handed over to the district boards and funds supplied by the government for their maintenance. The extent of the provincial charges would thereby be considerably reduced.

(6). Having eliminated the unimportant districts I would divide the remainder up into Public Works Department provincial divisions. Each Executive Engineer would have a Personal Assistant who would be an Assistant Engineer or senior upper subordinate. There would be no sub-divisional officer, but a set of subordinates would supervise and make measurements. Contracts would be given out by the Executive Engineer. Bills would be made out in the Executive Engineer's office, and payments would also be made by him direct. All petty projects would be prepared by the Executive Engineer and carried out by him. Large and important designs would be prepared in the Chief Engineer's office by the technical section. The Architect would advise in architectural matters. If it is thought desirable to permit outside competition for any particular design there is no reason why this should not be done.

(7). It might be possible to reduce the circles to three instead of four, but a fourth Superintending Engineer would have to be in charge of the technical branch of the Chief Engineer's office. The Consulting Architect and Electric Inspectors should be of the same standing as a Superintending Engineer. I would have spare men for a construction division (which would be necessary in case of large works) and to fill leave vacancies. The sanitary works of the province would be worked much in the same way as they are now. District boards might call for projects either from their own district board engineers or consulting engineers as the case may be or from the Sanitary Engineer. In any case schemes above a certain sum would be vetted by the Sanitary Engineer.

(8). It does not seem to be necessary to give anything but a general outline of the system I propose, but what I would like to impress on the Committee is that the Department must be divided up into special branches each under a specialist. Each branch would train its own engineers.

3,823. (IV.) Relations with other departments and sub-branches.—The Public Works Department broadly meets the needs of other departments in the administration, but delays are frequently complained of. The time has I think come to divide up the Buildings and Roads Branch into two as I have described above, each branch with its experts. Each branch should work independently of the other and I think the division would result in acceleration of work. At present the Chief Engineer has far too much to do. If he were relieved of all sanitary work things would get on faster. The division of the Department too would lead to greater efficiency.

(2). The branch of sanitary engineering should perhaps also have a Chief Sanitary Engineer with the Government of India. His duties would be to co-ordinate systems of work in the different provinces.

(3). I consider that the Department should be relieved of all responsibility for the design and execution of small works. I have a feeling that we take too much on ourselves. Departments should be encouraged to carry out works up to larger limits without reference to the Public Works Department.

3,824. (V.) Decentralization.—As regards further decentralization I am not in favour of giving subordinate officers any further powers. I do not think that further decentralization is possible or justifiable until we can improve the class of sub-divisional officer. I have no improvements to suggest in this direction, but I would give further powers to Executive Engineers with regard to excesses over estimates in order to minimize the necessity for revised estimates.

3,825. (VI.) Simplification of procedure.—I do not think that the rules in the Public Works Department Code which regulate the execution and maintenance of civil works are unduly restrictive as a whole. There is one point however which calls for attention and that is the lapsing of funds at the end of March and the consequent rush of work in that month. Some arrangements seem necessary by which funds, if not spent in one year may be carried on to the credit of the work in the next. It seems unfortunate that our financial year ends in March; if it were to end in June we should have nine working months on end and the rush of work at the end of the year would not be half as great. I cannot think of any other points on this subject which call for remarks, but selected Executive Engineers might be given further discretionary powers as regards sanction of estimates, reappropriations of funds, alterations of designs and excesses over estimates, approximating roughly to those exercised at present by the Superintending Engineers.

3,826. (VII.) Education.—I think that the engineering education given at the engineering colleges in this country is quite good, but I feel that the colleges do not give sufficient instruction in the practical design of structures, and would draw attention again to my remarks *supra*.

(2). I think a course of three years is sufficient for the present. Practical training cannot be given in a college, but the better the theoretical training the better the engineer. I would lay particular stress once again on the necessity of arranging the course of instruction in engineering so as to fit in with the instruction given in the theory of structures. I would also plead for a higher mathematical standard in the examinations for entrance into the colleges, but on this point I do not feel competent to offer advice.

3,827. (VIII.) Practical training.—I have said in my preamble that I think a deal too much stress is laid on the year's practical training for engineer students on works. My argument is that a year's practical training can only give the student an idea of how materials are manufactured and put together. It certainly cannot make him a finished engineer and it will certainly not go far towards enabling him to solve the thousand and one difficulties which he will surely meet with in the course of his career. As he gets on in life he will get his practical experience in spite of himself and he will never gain so much as when he has large works in his sole charge. I draw attention again to my remarks *supra*.

(2). I would make much larger use of the technical section in the Chief Engineer's office proposed by me. I would attach apprentices to Chief Engineers' and Sanitary Engineers' offices for a year to enable them to see how schemes are drawn out in practice. They would check projects passing through the office, take out calculations and generally help in the preparation of new schemes. During this year they would be sent out at the Chief Engineer's discretion to take notes on large works in the course of construction in various parts of the provinces. They then, if well reported on, would be fit to go out into the world as Assistant Engineers. Government would take their choice from among these men through an advisory board. The apprentices who failed to get government appointments would thereafter fend for themselves and those who were chosen would join the Public Works Department as Assistant Engineers as they do now.

(3). I have said that I am in favour of specialization in the Public Works Department, indeed I think it an absolute necessity. After five years' service in any

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particular branch of the service the Assistant Engineer might be permitted to take a year's special leave and study his particular branch of engineering and the government should arrange for his instruction or he might be allowed two lots of six months at a time and this would probably be more satisfactory.

(4). I think special courses of study should not be permitted at an earlier stage in the engineer's career because he would not be able to appreciate their value and he might omit to study certain essential and important particulars.

(5). These are broadly the main features of the practical training I would recommend.

3,828. (Conclusion.) I much regret that it has not been possible for me to do more than outline my ideas on the questions raised for discussion. But, now that I have explained that it might be possible to execute the ordinary public works of a district board through private agency and by the employment of temporary engineers, I would like to point out that there are certain considerations which make it difficult to dispense with the services of a complete organization like that of the Public Works Department. I refer particularly to famine. I do not know whether calamities of this kind are now possible, but should they occur (and I think they might occur if we have two consecutive bad monsoons), we have a very perfect knowledge, after years of experience, of how to face difficulties of this kind, and our accounts systems, both of compilation and audit, are worked out to a nicety. Our ordinary works go along the same as ever, and famine works also fall into line without much fuss. If our permanent Public Works Department establishments are reduced as I have indicated in this note, it will not

be possible to expand them at a moment's notice. The management of famines will have to be entrusted to local bodies. It will become a local rather than a provincial affair.

(2). Now I ask, would this be a wise proceeding? I, personally, do not think so. The whole Famine Code would have to be revised and the whole official machine would be thrown out of gear, besides which the whole system of accounts would have to be revised to suit the local boards and their consulting engineers. Experience has shown that consulting engineers are not always expert accountants.

(3). I do not wish to give the impression that I am writing from the point of view of a partisan. Perhaps some method might be devised to meet this difficulty—a difficulty more or less peculiar to this country. Perhaps the accounts could be compiled and audited in the Collectors' offices, but would we not be overburdening that official? I do not like the idea, but I feel sure most Public Works Department officers would welcome the change.

(4). The more I think of it the more I am convinced that the Public Works Department should remain for the present. Private firms can easily be encouraged to design and carry out works in their own special branches—there is heaps of room for both agencies. I am averse to any drastic changes at present and though I would like to see improvements in the Public Works Department, and though I would like to see it relieved of a lot of its work—especially that of a petty nature—I think it would be a great mistake to reduce its strength, at least for many years to come.

MR. A. C. VERRIERES called and examined.

3,829. (President.) The witness stated that he was a Superintending Engineer of the Public Works Department with 24 years' service, the first seven years of which had been spent in the Irrigation Branch and the remainder in the Buildings and Roads Branch.

3,830. It was not the practice to advertise tenders for large projects, and he could not remember any instance of this having been done. Special firms were not invited to tender for large works by sending them a separate intimation, and the usual practice was to post up notices in Executive and District Engineers' offices. The tenders posted up in the offices of district engineers were not lump sum but rate tenders, and the latter class of tenders was the best for India. In a lump sum contract changes in the construction of a building would probably necessitate extra measurements and work, etc., but where no changes were necessary in works which had been given out on a lump sum contract a schedule of rates should be attached showing the rates at which extra works had to be constructed. The rates for iron-work had recently increased considerably, but the contractor was allowed increased rates for work of this nature if he represented that he was losing. The instance was probably an exceptional one due to the war, but an increase would be allowed even in normal times on receipt of a reasonable representation.

3,831. The question whether tenders were invited partly or wholly for projects depended on the size of the work. For example, the High Court in Allahabad, the cost of which was Rs. 15 lakhs, was split up into two parts, and each was undertaken by different contractors, as the work was too large to be undertaken by one contractor and as its splitting up expedited the work. Entire tenders for ordinary contracts the value of which was Rs. 1 or Rs. 2 lakhs were invited. The system of giving separate contracts for iron-work, etc., was not usually followed, except in the case of bridge construction where steel girders were obtained from firms and therefore excluded from the contract. Contracts for materials, apart from construction, had only been occasionally given in cases in which estimates had not been sanctioned for works which it was known would shortly be constructed. In such cases a separate estimate was prepared for the collection of materials and it

was usually undertaken by the contractor to whom the construction of the contemplated work was eventually given.

3,832. The system under which contractors were classified according to their capabilities had not been adopted in the province, but it was desirable, and the classification should depend really on the financial abilities of contractors since they possessed no real technical knowledge. The question as to how contractors would be moved from one class to another would depend on the period they had been working for the Public Works Department. Such classification would be rather a difficult matter in the first instance, but it would not lead to much trouble in the long run. To become eligible for classification, contractors should have worked 20 years for the Department. This would ensure their being conversant with the ordinary principles of building construction, but there was no need to make it a hard-and-fast rule. For example, if a reliable firm of English contractors set up in the province, he would not preclude them from classification until they had worked for the Department for 20 years. His suggestion really referred to those contractors who at the outset were ignorant of the principles of building construction and departmental usage.

3,833. There were very few large firms of contractors in the province which were capable of undertaking the construction of large works with their own engineering staff. The reason for this was that there was not enough profit in the construction of work for the Public Works Department. Throughout his experience, he had known of only one or two petty contractors whose sons had followed their fathers' profession and this seemed to indicate that contracting work was not popular.

3,834. He had recently made a comparison of the cost of a Public Works Department building with that of a building constructed by private enterprise. The case in point was that of a firm in Lucknow which had constructed a work at rates 10 per cent. below those of the Public Works Department. There were no special reasons, as far as he was aware, why the firm in question should construct work below the rates of the Public Works Department, but if the latter had constructed the building the rates would not necessarily have been

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10 per cent. more than those of the private firm because the tender for such work might have been below the schedule of rates. It had been his experience that the Department usually constructed works only a little below the schedule of rates, and there were no special circumstances connected with the building in question which led him to believe that the Department could have undertaken its construction at rates 10 per cent. below the schedule of rates. The comparison he had made did not relate to the actual cost of the work but only to the rates. In addition the firm had allowed 7 per cent. for supervision, as compared with 16½ per cent. the establishment charges of the province as a whole. Hence the rates of the private firm were 10 per cent. below those of the Public Works Department plus 7 per cent. for supervision, and the difference was considerable. The rates of the Department, however, referred to a large area and to buildings both large and small. He was therefore not prepared to state that the departmental establishment charges would have been 16½ per cent. had the building, or other concentrated work, been constructed by the Department.

3,835. Local boards should have the option of employing firms of consulting engineers for the design of their buildings, as the present system was not wholly suitable. The rules in connection with the preparation of the designs of such boards laid down that designs for works costing more than Rs. 3,000 should be prepared by the Public Works Department, and there was no reason why these designs should not be given out to competition. If district boards desired the construction of all their own works they would have trouble in recruiting engineers for the purpose, as difficulty had always been experienced in securing the right type of men. This difficulty could only be surmounted by making their appointments permanent and pensionable as was the case in government service.

3,836. Provision was not generally made in estimates for the construction of buildings for establishment charges in addition to the ordinary establishment charge of 16½ per cent., except for *mistris* in the case of large works. The charge in this respect, however, was small. Provision was also made in the case of bridge construction when professional well-sinkers were employed. In addition, a provision of 5 per cent. was made for unforeseen contingencies.

3,837. He was in favour of greater specialization in the Department and recommended that the Sanitary Branch should be entirely separated from the Buildings and Roads Branch and placed in charge of a Chief Engineer, so that the establishment in the Sanitary Branch would eventually undertake the construction of the sanitary work only and thus specialize in that class of work. The Sanitary Branch employed a separate construction staff at present but all sanitary works were not constructed by that staff as some of the municipalities employed their own engineers for the purpose. The Sanitary Engineer, however, designed and constructed the majority of sanitary projects. The ordinary Public Works Department staff had previously constructed some of the sanitary works, but such was not the case at present. The expenditure on sanitary works had been Rs. 20 lakhs in 1915 and Rs. 23½ lakhs in 1916. The Sanitary Engineer moreover had in 1914-15 drawn up sanctioned projects amounting to Rs. 18 lakhs, projects submitted but not sanctioned amounting to Rs. 3½ lakhs, and projects the preparation of which was at present in hand amounted to Rs. 97 lakhs. Hence the expenditure on sanitary works was sufficient to justify the appointment of a Sanitary Chief Engineer, and it was impossible to think that this expenditure was not on the increase.

3,838. The Chief Engineer of the Buildings and Roads Branch should be relieved of a certain amount of his duties by the creation of a technical branch under a Deputy Chief Engineer, whose status should be that of a Superintending Engineer. Superintending Engineers submitted projects which exceeded Rs. 50,000 for the technical sanction of the Chief Engineer, and a large number of such projects could be technically sanctioned by Superintending Engineers, thereby relieving the Chief

Engineer somewhat as regards the accord of technical sanction. Hence he was in favour of the delegation to Superintending Engineers of powers of administrative sanction up to Rs. 1 lakh. The technical branch he had suggested would enable the Department to give apprentices an excellent training in practical designing. There was at present a great dearth of superior engineering establishment and it was quite the exception to have an Assistant Engineer in charge of a district. In the hill districts, however, Assistant Engineers were usually placed in charge, but even then one man had too much to do. Six or eight large bridge designs was nothing uncommon to have on hand at one and the same time and it was impossible to expect one man to turn out expeditiously that number of projects single-handed. Hence if details as regards waterways, etc., was furnished the designs for bridges could be quickly executed in a technical branch. The technical branch would also prevent duplication of work in so much that designs could be standardized and the same design might be used in several localities. The bridges in the province were not of sufficient importance to require the services of a specialist in bridge construction as the designs could be prepared by an ordinary engineer. He had suggested a technical branch because of the complaints of delay made against the Department, which were due to the employment of far too few officers. Assistant Engineers could not be relieved periodically, as there were far too few Assistant Engineers in the province.

3,839. District boards should be responsible for their own local works and also for unimportant provincial works in unimportant districts, e.g., a few miles of provincial roads, *kutcherris* and judges' courts, etc., and he recommended that a start should be made in this direction in the smaller districts. It would reduce the extent of provincial charges, but it would lead to the overlapping of the work of district board and Public Works Department engineers. It might be possible for irrigation engineers to maintain buildings of the Buildings and Roads Branch, but the irrigation and buildings and roads districts did not coincide, as irrigation works only existed in certain portions of the province which were under irrigation. The principle, moreover, of making the irrigation engineer subordinate to the Chief Engineer for Irrigation as well as Buildings and Roads was not sound. It would be economical if district boards were made responsible for the maintenance of Public Works Department buildings in addition to their own, provided such bodies maintained as efficient a staff as the Public Works Department, from which Superintending Engineers could be recruited for inspecting, designing and constructing the limited number of large works which government would not transfer to the district boards. The system could not, however, be introduced at once, but it might eventually be an improvement over that at present followed.

3,840. The Public Works Department should be relieved of a considerable amount of its work, especially that of a petty nature which consisted of the construction of small works as well as of a large mass of repairs, e.g., that costing Rs. 3,000 to Rs. 5,000 in outlying portions of districts which did not require much engineering knowledge should be handed over to district boards at once, if the boards had slightly better staffs.

3,841. A great deal of the time of Executive Engineers was needlessly taken up with the preparation of repair estimates and he was of opinion that such estimates should be more or less lump sum estimates. Under the present system, repair estimates were prepared for each work, a grant being assigned to each which could not be exceeded, and it was impossible for the Executive Engineer to supervise all repairs for which estimates had been made. So long as standard measurements were entered in standard measurement books no great loss could be incurred, and if the Executive Engineer were allotted a lump sum grant for repairs to each building—the money being spent at his discretion—an enormous saving in time and labour would result.

3,842. He had been a divisional engineer for six years only, out of which three years had been

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spent in the Secretariat and two years on leave. Accounts could not be divorced from works as the Executive Engineer had to know how the expenditure on his works was progressing. The introduction of a more simple form of account in this connection was a matter for the consideration of the Accounts Department, but he was personally of opinion that the present system was a rather good and effective one. A considerable saving in labour would however be effected if the Executive Engineer were allowed to keep a system of accounts to serve his own purposes only and if he were not obliged to compile accounts for the information of the Accountant-General. An Executive Engineer did not devote more than an hour a day to his accounts as he employed a fairly large staff for the purpose, which consisted of an accountant, an assistant accountant and various other clerks. The complaint that Executive Engineers spent a great deal of their time on accounts work was therefore exaggerated.

3,843. (Sir Noel Kershaw.) There were no quantity surveyors in India and a certain amount of leakage was inevitable whether district board engineers or private firms were employed for the construction of buildings. Private firms did not supervise their works sufficiently and although their living depended on the construction of work, they were not capable of checking their measurements without the aid of a subordinate staff. It was rather difficult to dispense with the services of Public Works Department subordinates. Hence he thought that they should be either altogether temporary or permanent but liable to summary dismissal when necessity arose. In the latter case a court consisting of three Superintending Engineers should investigate any cases of laxity and the services of offenders should be dispensed with on the recommendation of the court, no appeal being allowed. In the case of subordinates other than lower subordinates, the decision of the committee should be submitted to the Chief Engineer who should be allowed the casting vote.

3,844. The time had not yet arrived when contractors could be permitted to supervise works in which they were personally interested. If they were to be employed purely as contractors it would not pay them to employ engineers as the rates would not permit of outlay on an expensive establishment. There would besides be great difficulty in convincing them of the necessity of employing engineers when they had hitherto been able to obtain the services of engineers free. No other system was therefore possible at present. Even though certain contractors had been undertaking the construction of departmental work for a good many years, they still required supervision throughout the construction of a work.

3,845. (Mr. Mackenzie.) The Department could construct work at 10 per cent. below the schedule of rates in Lucknow where the firm previously referred to had constructed a work at similar rates, but such a course would not apply in all cases. In the case of one large work which cost about Rs. 2 lakhs, the Department had actually received tenders at 13 per cent. below the estimated rates.

3,846. Not much profit could be made out of the Public Works Department rates as the schedule of rates referred to each district. For example, one schedule was not prepared for Lucknow, another for a place 10 miles distant and another for a station 10 miles beyond that. Hence it was possible that the schedule of rates might be correct for a place 10 miles distant from Lucknow and a little too high for Lucknow itself. All estimates were based on the schedule of rates and the quotation of rates rested entirely with the contractor.

3,847. It was not the practice in the province to add 5 per cent. to estimates on account of supervision. But on large works such as the Medical College something was allowed for establishment and tools and plant and this amounted to about 1 per cent.

3,848. It was rather difficult for the officer who paid bills for repairs to check the measurements in all cases. The Department, however, employed a subordinate staff for the taking of measurements. These were submitted

to the engineer and bills drawn up in respect thereof and paid if they were reasonable. Engineers could not, however, make the initial measurements as they did not have the time to do so.

3,849. Repair estimates were drawn up annually from the standard measurement books. These showed the amount of white-wash necessary, the area of doors, roofs and tiles, etc., in a particular building. As repair estimates were framed before the repairs were actually necessary and it was impossible to foresee all that would be required he was in favour of the preparation of lump sum estimates.

3,850. Once the accounts of an Executive Engineer were compiled and sent out of his office they were of no use to him with the exception of the register of works and a few other documents which showed the progress of expenditure on works. As a matter of fact, the accounts were only of use to the Accounts Department, and Executive Engineers did not take much interest in them.

3,851. (Rai Bahadur Ganga Ram.) He possessed powers of technical sanction up to Rs. 50,000 irrespective of whether buildings were constructed on standard plans or new designs, and was in favour of a differentiation in this respect. This would involve the fixation of a higher limit for standard designs than for new designs, and the same principle should be applied to an Executive Engineer's powers of technical sanction.

3,852. A schedule of rates was fixed for each district. The 10½ per cent. establishment charge related to the whole province and covered many items which would not relate to work in one particular place. It also did not take into account the cost of the preparation of plans and estimates for projects which never materialized. The establishment charges would not, he thought, amount to more than 5 per cent. for the construction of concentrated work.

3,853. A great deal depended on the district engineer himself in the matter of repairs to buildings as the Executive Engineer could not supervise the repairs to every building in his division. He had, but not recently, compared the rates of the Public Works Department with those of the Railway Department and found that the latter were somewhat higher.

3,854. The Department had several standard plans which were revised periodically, but he had not known of a case in which other provinces had been consulted when such revision had taken place. There should perhaps be uniformity in this respect, but the question was one for the Chief Engineer to decide.

3,855. (Mr. Cobb.) The employment of petty contractors for the construction of work did not debar large contractors from undertaking the construction of the whole of a work or retard the development of such men. As a matter of fact, one contractor was usually employed for the construction of an entire work, except in the case of large works such as the Medical College where the contract had been divided into parts, each of which cost about Rs. 2 to 6 lakhs, in order to expedite work. Contractors had no desire to employ an establishment of their own; the custom for years had been to employ petty contractors.

3,856. The statement in his written evidence to the effect that contractors knew the ways of the Public Works Department referred to the methods of construction, i.e., contractors knew exactly what to do and what the Department exacted in the way of work, what good masonry was, etc. There were only two or three contractors in the large districts and it rested between them as to who would be successful in securing a large contract. The man who would eventually be chosen was, however, more or less known beforehand.

3,857. He had often thought that requisitions for repairs should be submitted by the district surveyor to the Executive Engineer, but the objection to such a procedure was that it would increase the work of that officer as he would have to submit many requisitions. The Executive Engineer's work would also be increased if he allotted grants, as subordinates would constantly send in requisitions for repair work. There were not

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many complaints under the existing system, and repairs to buildings were carried out in a fairly satisfactory manner as district engineers were continually supervising such work. On the other hand, if that officer did not exercise proper supervision, it was not possible for the Executive Engineer to do so.

3,858. The methods of the Public Works Department did perhaps give rise to rapacity amongst the subordinates as too much was left in their hands. Contractors, however, had a very much firmer hold on the subordinates they employed and therefore did not perhaps suffer quite as much as the Department in this respect.

3,859. There had been a complaint in the past regarding various projects which had been called for and which had not materialized, the Police Department having been the offenders in this respect. The Department had had as a matter of fact lakhs of rupees worth of projects in hand for which the Police Department had not the necessary money for their construction, and a government order had therefore been issued to the effect that no project should be called for unless there was a belief that the necessary money would be forthcoming within a reasonable time.

3,860. The pay of third grade subordinates had been increased from Rs. 25 to Rs. 30 a month. He advocated that lower subordinates should all commence on one grade of Rs. 50 a month but did not think that wage would put a stop to speculation.

3,861. (President.) The contractors employed by the Department mostly supplied their own tools and plant with the exception of special items required for large works, e.g., dredgers. The Department did not pay for tools and plant used by contractors. Contractors sometimes supplied mortar mills.

3,862. He was in favour of the employment of large contractors, but considered it was difficult to formulate suggestions for their encouragement. The Department did not, however, discourage such men. On the other hand, it did not encourage them to design and carry out their own works. In any case, there was nothing in the

working of the Department which discouraged large contractors.

3,863. The construction of electrical works had recently been commenced in the province by a large firm of electrical engineers. Although this was a new industry in the province for which outside agency was available, he did not know why for an old industry like that of the building trade, large contractors were not available to carry out work. It was, however, perhaps due to the fact that there was not sufficient profit in the rates of the Department.

3,864. (Mr. Willmott.) The Public Works Department schedule of rates were fixed so as to allow a margin of 10 per cent. profit to contractors. The construction of bridges, machinery, water-works and the like had been entrusted to large firms of contractors, and his statement that no large firms were available for the construction of work referred only to buildings.

3,865. He had only one class of contractor on his list and had never tried any other in connection with the construction of work. He had never met the contractor from whom supervision could be taken away absolutely, but it was quite possible to take away more from one man than from another and it was also possible to introduce a sliding scale for the classification of contractors.

3,866. The proportion of repair work which could not be foreseen would probably amount to about one quarter of the whole. Such could perhaps be dealt with separately, but in that event $\frac{3}{4}$ ths of repair estimates would have to be based on certainty and the remaining $\frac{1}{4}$ on uncertainty; and the Executive Engineer would have to prepare two estimates for sanction instead of one. Estimates for the former class of expenditure were not objected to in audit, and if such was the case with regard to unforeseen items the difficulty would be surmounted.

3,867. One year was not sufficient for the training of an Apprentice Engineer, and a period of two years was preferable.

THE HON'BLE MR. C. F. DE LA FOSSE, Director of Public Instruction, United Provinces.

Written Statement.

3,868. The attached note (Annexure I), written at the request of the Chief Engineer to Government, on the question of employing private agency to erect buildings for the Education Department will I hope prove useful to the Committee. It gives a detailed account of the arrangements made and of the way in which procedure was adjusted to meet the altered conditions. I understood that I had been selected as a witness by the local Government because it was thought desirable to place at the Committee's disposal the experience gained by me in this matter and that I was not expected to furnish views upon purely technical questions. The Chief Engineer has, however, at the last moment requested me to furnish my views upon all the subjects of inquiry, whether or not, apparently, I am qualified to do so. As my views on matters in regard to which I have no title to offer an opinion must be practically valueless I trust that the Committee will be indulgent, if they find them so.

3,869. (I.) Economy and suitability of methods of execution of public works.—I have heard it frequently stated by managers of schools that contractors work more cheaply when they deal with them direct. An American missionary who was at one time in charge of a large high school at Lucknow told me that if he were obliged to submit his plans, estimates and specifications for Public Works scrutiny contractors would charge so much more that it would not pay him to accept a grant from government towards the cost of the building which he wished to erect. In the end he did accept assistance and a building which he hoped to erect for about Rs. 70,000 cost upwards of a lakh and the delays over sanctioning plans and estimates tried his temper a good deal. He complained that the grant of Rs. 30,000 which he got from government did not recompense him. It

would not be justifiable to make sinister deductions from this statement; but it is fair to conclude that Public Works Department scrutiny and supervision means that contractors will charge higher rates than they would otherwise do. The Public Works Department will probably reply—and with reason—that higher rates must be charged if good work throughout is insisted upon. There are, however, within my knowledge examples of buildings erected more cheaply, which have stood the test of time and wear quite as satisfactorily as any buildings either erected by the Public Works Department or supervised by the Public Works Department in course of erection.

3,870. (II.) Encouragement of other agency.—This is answered as fully as I can answer it in the note referred to above. I need only add here that Messrs. ———— would be willing—indeed would prefer—to maintain in good condition the buildings erected by them on the same terms as the Public Works Department maintains buildings erected by it. I am, myself, of opinion that the present system of maintaining buildings is not very satisfactory. Annual repairs are not always well done and there is sometimes avoidable delay in executing them. Private agency might perhaps work more quickly and cheaply and the officers concerned would probably see to it that bills were not paid till the work had been properly done.

3,871. (III.) Changes in organization.—My own opinion is that the Public Works Department should gradually shrink into a department for supervising not for executing work. Wherever private agency is trustworthy and sufficient the Public Works Department should endeavour to reduce its establishment and surrender the actual execution of works to private agency. Unless it begins to shed in this manner its functions as a constructional department the growth of private

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agency will continue to be stifled. One way in which the Public Works Department might give more assistance than it does is in the preparation of plans and estimates of buildings for schools and colleges privately managed. Managers and governing bodies have in many parts of the United Provinces great difficulty in getting competent persons to prepare such estimates for them. I have sometimes thought that the difficulty might be solved by the employment of a Consulting Architect for my Department; but it would be better perhaps that he should be an officer of the Public Works Department as he would have to work in close conjunction with officers of the Public Works Department. There is a great deal of school building going on in the United Provinces now-a-days, and the need for an architect who could examine plans and estimates or even prepare them *ab initio* is constantly making itself felt. Local contractors are competent enough, as a rule, to carry out work according to designs—under supervision of course, but they seem seldom able to prepare plans and estimates of which the Public Works Department is able to approve. The patience of Public Works Department officers is apt to be strained to the breaking point by repeated failure to comply with departmental requirements and managers and committees on the other hand, being in urgent need of new buildings, blame the Public Works Department officers for delays over the preparation of plans and estimates which are often quite inevitable.

3,872. (IV.) Relations with other departments and sub-branches.—Speaking for my own department I have no serious grounds of complaint, except on the score of delays and expense, and upon both these it is possible to frame hasty judgments without a true appreciation of the difficulties. The Public Works Department procedure strikes me as cumbersome and inelastic in its dealings with schools which are privately managed. I give below a brief account of a case which is typical of the way in which it deals with plans and estimates sent to it for scrutiny. No doubt in this case the manager of the school was exasperating in his ignorance of procedure and his inability to understand and comply with requirements; but although he was ready enough to be guided, he could not follow the instructions given to him and after much helpless blundering he found himself at the end of 2½ years precisely where he started, *vide* brief note on the case of the Hindu Coronation School, Moradabad (Annexure II).

3,873. (V.) Decentralization.—I have touched on this point in my note on the question of employing private agency. There does seem to me sometimes a very lengthy chain of correspondence and this inevitably causes much delay; but I am not familiar enough with the working of the Department to be able to suggest ways in which decentralization is possible and expedient.

3,874. (VI.) Simplification of procedure.—I can give no help in solving this question because I do not understand the use of the word "restrictive"—restrictive of what?

3,875. (VII.) Education.—This question raises issues upon which I have never been able to see eye to eye with the Public Works Department. I put in a copy of a joint inspection report upon the Roorkee Engineering College written in November 1911 by Mr. Goument, a former Chief Engineer, Dr. Hill, professor of chemistry at the Muir Central College, and myself (Annexure III). I believe that the remarks made therein upon the teaching of engineering are still substantially true and that there has since been no attempt at corporate life and little improvement in academic atmosphere. The truth is that the Public Works Department desires to use the college as a place in which to train Assistant Engineers for immediate employment, and to this end it makes a point of professional routine training at the expense, as some of us think, of the training of the students as qualified civil engineers. I understand that the members of the Indian educational service now serving on the staff of the Roorkee College intend to furnish the Committee with their views upon the subject. I need not therefore enlarge upon this point, since I share their views; but I

shall be glad to discuss the matter with the Committee should it desire to enter into it with me.

(2). Upon the question of the recruitment of students I have always been and still am of opinion that many enter upon their training at too late an age. I should like to see the college affiliated to the Allahabad University and the students entering upon their professional training at about the age of 18. The possession of a degree in engineering would, in this country, prove an attraction and the college would then secure its fair share of the best of the younger men. A student who has just graduated in Arts or Science is no doubt well qualified educationally to take up courses in engineering but he has by the age of 21 or 22 acquired an inclination to sedentary pursuits and is less malleable. If he has taken his B. Sc. degree he probably knows more pure physics, chemistry and mathematics than he needs as a general introduction to engineering studies, but his four years spent at an Arts college have not fitted him for an active career.

ANNEXURE I.

Note to Chief Engineer. Dated 27th January 1917.

I enclose a statement giving the information in convenient form regarding buildings entrusted to Messrs. _____ for construction. I also enclose a statement giving similar information regarding high schools constructed recently by the Public Works Department. These two statements should be compared. I have inspected at different times all these buildings and during my rains' tour I took occasion to visit all the buildings in process of construction by Messrs. _____. In some cases the progress made was slower than had been expected, but a comparison of the two statements will show that Messrs. _____ are able to build a good deal faster than the Public Works Department. There may of course have been difficulties which unavoidably delayed the construction of buildings by the Public Works Department and which render such a comparison fallacious. The work of the former as far as I was able to judge was satisfactory and the materials used were of good quality. Independent opinion endorsed my judgment and in one or two cases I had tests of the quality of lime made before me. I was well satisfied with the wood-work in doors and windows. I have found the firm eminently reasonable about alterations which in the course of construction were found to be desirable.

The question of cost of building through the agency of Messrs. _____ as compared with the cost of construction by the Public Works Department is difficult to determine owing to the considerable rise in the cost of materials, especially iron girders, since the commencement of the war. Messrs. _____ believe that they are able to build at 10 per cent. less cost than the Public Works Department including supervision.

Some administrative difficulties have been met with in carrying out the work through the agency of Messrs. _____ owing to their insisting upon regarding themselves as architects and engineers under whose direction work is carried out for the Department by contractors. They claim in fact to be regarded as departmental architects and engineers for the purpose of constructing buildings for the Education Department. The Public Works Department objected to their employment under such conditions and these objections had to be over-ruled. The Public Works Department, to whom Messrs. _____'s plans and estimates have been sent for scrutiny, criticized them on structural grounds; but the objections have been mainly based I understand upon the fact that Messrs. _____ follow the specifications of the Board of Trade in Great Britain while the Public Works Department follows those of the Indian Military Hand Book. The relative merits of the two systems is one which none but an

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expert can pronounce an opinion upon; but the Public Works Department has I believe admitted the general soundness of Messrs. _____'s designs and specifications.

A further difficulty is likely to arise over the passing of Messrs. _____'s accounts, unless government is prepared to waive the necessity for their presentation in a form which will satisfy the requirements of the Accounts Department, as laid down for buildings constructed by the Public Works Department. I am personally of opinion that it would not be just to require a private firm of architects and engineers to adopt a system of accounts which though suitable for the Public Works Department might not entirely suit the business methods of a private firm. After the Public Works Department has scrutinized the plans, specifications and estimates and if the work of construction is found to conform to them and to be in all respects satisfactory, I do not think that a private firm should be required to submit accounts in a particular form merely because it is convenient to an Examiner of Public Works Department accounts.

To refer again to the question of the cost; it might perhaps be possible for experts to decide whether the Public Works Department or Messrs. _____ build more cheaply by comparing the estimates for the Government High School, Cawnpore, with the estimates for the Government High School, _____. The former will be constructed through Public Works Department agency and the latter through Messrs. _____. The schools are both first grade government high schools and the design adopted in both cases is practically the same.

With regard to making payments to Messrs. _____ government directed me to consult the Accountant-General. Advances were made to the firm from time to time to meet disbursements for material and labour. Accounts of expenditure by the firm were subsequently submitted to the Accountant-General in accordance with his directions. The Director of Public Instruction being the disbursing officer, the accounts were submitted through his office. All payments in advance were made with the previous sanction of government. Bills received from the firm in adjustment of the advances were submitted to the Accountant-General along with the accounts of expenditure on construction. It is in reference to the final passing of accounts that difficulties have arisen. It will be perhaps helpful if I give a detailed account of the procedure which is adopted in the preparation of projects by the Public Works Department.

(1). A need for a particular work is usually reported by a subordinate officer. If the Director of Public Instruction approves of the proposal the subordinate officer is authorized to ask the Public Works Department for a preliminary project. A good deal of delay often takes place in the selection and purchase of a suitable site. For this delay the Public Works Department is in no sense responsible.

(2). Approval having been given for the preparation of the preliminary project, the Executive Engineer asks the district engineer to prepare it in consultation with the local officer of the Department. But before this is done, the Department satisfies itself that the actual requirements have been clearly set out.

(3). The district engineer having prepared the preliminary project sends it to the Executive Engineer and the latter sends it with his own comments either direct or through the Superintending Engineer to the Director for administrative sanction.

(4). The Director sends the project to the departmental officer concerned for an expression of his opinion. But in some cases this opinion is obtained by the Public Works Department before sending on the project to the Director.

(5). Large projects are sent to the Chief Engineer for professional opinion and scrutiny before administrative approval. When the administrative approval has been obtained the plans and estimates are sent back to the Public Works Department officer concerned and may

in some cases have to pass to and from a district engineer through all grades of officers up to the Chief Engineer and the Director for final approval.

It frequently happens that the Public Works Department has to report that the funds allotted for expenditure during the financial year have not been fully spent. Lapses are reported and further funds have to be provided for the prosecution of the work in the next financial year. The procedure followed in the case of buildings entrusted to Messrs. _____ has been somewhat different.

(1). After permission of government is obtained to enter into negotiations with the firm for the construction of a particular building the firm is addressed by the Director and asked if it will undertake the work. If it agrees, it sets to work to prepare plans and estimates, etc., according to a definite statement of requirements.

(2). When the firm has prepared plans and estimates they are scrutinized by the Director of Public Instruction and the departmental officer concerned with reference to their suitability, and after consideration of any changes that may be necessary they are finally sent to government in the Education Department.

(3). When the plans and estimates have received the approval of government a deed of agreement in the prescribed form, *vide* G. O. No. 1795 C. B.—2292, dated 10th July 1915, is executed (Annexure IV).

(4). Public Works Department supervision is not exercised during the course of construction unless for any particular reason the Director of Public Instruction invites it.

(5). In the agreement a period within which the work should be completed is fixed. I have not thought it proper to enforce this condition strictly, since the difficulty of obtaining materials during the war has interfered with construction and sometimes unreasonable weather has caused delays.

In working through Messrs. _____ I have endeavoured to avoid with the approval of government hampering them with formalities such as are imposed under the Public Works Department and Account Codes in the case of buildings constructed by the Public Works Department.

The reason for employing Messrs. _____ instead of employing only the Public Works Department as heretofore is that it was thought necessary by government to supplement the Public Works Department by private agency with a view to carrying out as quickly as possible a large programme of new buildings for government high schools and normal schools out of funds provided by the Government of India. I am unable to say whether the employment of a private agency has really effected any economy for reasons which I have given above. But the employment of private agency has certainly speeded up construction. The decision to employ Messrs. _____ should not be regarded as any reflection upon the Public Works Department. In the case of buildings erected by Messrs. _____ I have had very little trouble and certainly much less correspondence than I should have had with the Public Works Department. The firm in my opinion builds quickly and well and the confidence which I have had to place in its reliability and honesty has not been abused.

I think it right to add in conclusion that the suggestion to employ Messrs. _____ came from government itself and that this firm occupies in the United Provinces a unique position. I think it would be dangerous to generalize from the experience gained with Messrs. _____ as to the advisability of employing private agency generally for such works as those in the construction of which the Department has employed Messrs. _____.

I am not, however, prepared to say that there are not other private firms which could be similarly trusted. If the Committee should come to Allahabad it might there inspect a building entirely designed and built through private agency. The MacDonnell Hindu Hostel is one of the largest buildings of its kind in India. The Committee which manages the hostel could give the

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[Continued.]

Public Works Committee a very interesting account of the way in which the building has been erected, and the Public Works Committee would be able to see for itself a building which down to the smallest detail is well planned and well constructed. The Indian gentlemen who supervised the work of construction were vigilant and exacting and they have seen to it that the contractors

employed upon the work have used good materials throughout and have scamped nothing.

C. F. DE LA FOSSE, M.A.,
Director of Public Instruction,
United Provinces.

DATED ALLAHABAD;
The 27th January 1917.

Statement showing certain information regarding the buildings which have been or are being constructed by Messrs.——.

Serial No.	Name of the buildings entrusted to Messrs.——'s agency for construction.	Total estimated cost.	G. O. sanctioning the plans and estimates, etc., and the agreement finally executed.	Period as mentioned in the agreement for completion of the building.	Probable date as intimated by Messrs.—— for handing over the building as completed to the Educational Department.	REMARKS.
1	2	3	4	5	6	7
1	Main building for the Government High School at Unao.	Rs. 62,439	G. O. No. 170—XV-8, dated 2nd February 1910	Seven months.	End of December 1916.	Funds allotted— (1) Rs. 20,000 in G. O. No. 53—XV-06, dated 12th January 1910. (2) Rs. 20,000 in G. O. No. 400—XV-06, dated 8th March 1910. (3) Rs. 22,439 in G. O. No. 494—XV-06, dated 13th March 1910. The completion report has not been received as yet.
1(a)	Servants' quarters in connection with the new building for Government High School, Unao.	2,153*	..	..	Under construction.	Ditto. * Funds allotted in G. O. No. 2142—XV-8, dated 26th December 1910.
2	New building for the Jubilee High School, Gorakhpur, with hostel and subsidiary buildings.	98,191	G. O. No. 170—XV-107, dated 3rd February 1910.	7 months.	15th December 1910, excluding supplementary project.	Funds allotted— (1) Rs. 5,000 in G. O. No. 1093—XV-06, dated 8th December 1915. (2) Rs. 20,000 in G. O. No. 53—XV-06, dated 12th January 1916. (3) Rs. 20,000 in G. O. No. 233—XV-06, dated 14th February 1910. (4) Rs. 53,191 in G. O. No. 494—XV-06, dated 18th March 1910. The completion report has not yet been received. † Recently submitted to government for approval and allotment of funds.
2(a)	Supplementary project (miscellaneous work).	7,280†	....	....	....
3	New buildings (including main building, science block and headmaster's house) for Government High School, Muzaffarnagar.	89,016	Project approved in G. O. No. 392—XV-445, dated 7th March 1910, and agreement executed in G. O. No. 777—XV-107, dated 12th May 1910.	7 months.	Inquiry has been made as to when they expect to complete the work.	Funds allotted— (1) Rs. 20,000 in G. O. No. 53—XV-06, dated 12th January 1910. (2) Rs. 20,000 in G. O. No. 400—XV-06, dated 8th March 1910. (3) Rs. 49,016 in G. O. No. 494—XV-06, dated 18th March 1910.
3(a)	Supplementary project (miscellaneous work).	7,757‡	....	....	....	‡ Only recently forwarded to government for approval and allotment of funds. The fair estimate for Government High School and subsidiary buildings at Cawnpore which was forwarded to government on 22nd November 1916, amounts to Rs. 1,41,118.
4	New buildings for Normal School, Fyzabad, with hostel and headmaster's house, etc.	73,751	Project approved in G. O. No. 625—XV-230, dated 22nd March 1916, and agreement executed in G. O. No. 777—XV-107, dated 12th May 1910.	7 months.	Funds allotted— (1) Rs. 20,000 in G. O. No. 153—XV-06, dated 12th January 1910. (2) Rs. 20,000 in G. O. No. 400—XV-06, dated 8th March 1910. (3) Rs. 33,751 in G. O. No. 494—XV-06, dated 18th March 1910.

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HON'BLE MR. C. F. DE LA FOSSE.

[Continued.]

Statement showing certain information regarding the buildings which have been or are being constructed by Messrs. ———— conold.

Serial No.	Name of the buildings entrusted to Messrs. ————'s agency for construction.	Total estimated cost.	G. O. sanctioning the plans and estimates, etc., and the agreement finally executed.	Period as mentioned in the agreement for completion of the building.	Probable date as intimated by Messrs. ———— for handing over the building as completed to the Educational Department.	REMARKS.
1	2	3	4	5	6	7
		Rs.				
5	New building for the Government High School, Bahraich.	1,28,201	Plans and estimates approved in G. O. No. 408—XV-28, dated 9th March 1916, and agreement after execution received with G. O. No. 777—XV-187, dated 12th May 1916.	7 months from the date of the execution of the agreement. (No date is given in the agreement.)	In the Firm letter, dated 25th November 1916, it was intimated that the buildings will be completed by Xmas when a completion report will be submitted. No completion report has yet been received.	Funds allotted— (1) Rs. 20,000 in G. O. No. 63—XV-96, dated 12th January 1916. (2) Rs. 20,000 in G. O. No. 408—XV-96, dated 8th March 1916. (3) Rs. 88,201 in G. O. No. 494—XV-96, dated 18th March 1916. (The full project for the new high school and subsidiary buildings at Bahraich which have received administrative approval of government subject to the remarks made in a professional note by the Chief Engineer, amounts to Rs. 1,10,825).
6	New building (main school building, science block, hostel and headmaster's house, etc.) for the Government High School at Bara Banki.	1,10,908	G. O. No. 2129—XV-39, dated 21st December 1916.	10 months from 21st December 1916, the date of execution of the agreement.	....	Government has ordered that funds, required for completion of the project should be paid before 31st March 1917. Specific sanction of government to the allotment of Rs. 1,10,908 has been applied for. Messrs. ———— have asked for an advance of Rs. 10,000 for collecting materials. The site selected has not yet been acquired. The matter is under correspondence with the Deputy Commissioner of Bara Banki.
7	New building (main building, science laboratory and out houses only) for the Government High School at Tazabad.	70,485	....	....	....	The plans, estimates, etc., were forwarded to government on the 30th November 1916, but they have not been received back as yet. The site proposed is mazar land and will cost nothing.
8	New school building and second hostel for the Government High School, Etawah.	1,25,454	....	....	....	The plans, estimates, etc., were submitted to government for approval on 2nd December 1916, but they have not been received back as yet.

Statement B showing certain information regarding some high schools constructed by the Public Works Department.

No.	Name of the building.	Estimated cost as finally sanctioned.	When originally initiated.	When finally sanctioned.	When completed by the Public Works Department.	REMARKS.
		Rs.				
1	New buildings for Government High School at Pilibhit.	1,10,921	January 1912 . .	12th October 1914. .	March 1915.	
2	New Government High School at Shahjahanpur.	70,000	February 1911 . .	21st June 1913 . .	March 1915.	
3	Government High School, Mainpur, and subsidiary buildings.	87,771	July 1911	22nd October 1912 . .	1st May 1914 (school) 1st April 1914 (hostel).	
4	Government High School with subsidiary buildings for Government High School at Etah.	80,278	February 1911 . .	22nd November 1912 . .	1st October 1914.	

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[Continued.]

ANNEXURE II.

Brief note on the case of the Hindu Coronation School, Moradabad.

The Hon'ble B. Brijnandan Prasad applied in June 1913 for a grant of Rs. 25,000 towards the cost of building a new school building for the Coronation Hindu School, Moradabad. Government approved the proposal and made provision in the budget for 1914-15. Plans had to be prepared and they were received in this office in May 1914. They were incomplete and so were returned by this office for some modification and addition. The completed project was resubmitted in November 1914 and was then sent on to Public Works Department for scrutiny. The project, it may be mentioned, had been prepared by an Assistant Engineer of the Oudh and Rohilkhand Railway Engineering Department. The Superintending Engineer in December 1914 returned the project not approved (*vide* copy of his letter No. 17299—1107 C. B., dated the 18th December 1914 attached) and it was then decided by the Manager in consultation with government to recast the whole project and build on a less expensive scale. There was considerable delay in trying to find a suitable plan that would be less expensive, and finally the Manager in June 1915 was allowed to adopt the standard plan for the high schools of the Department. The preparation of a fresh project appears to have taken nearly 10 months for it was not received until April 1916. The revised project was again sent on to the Public Works Department for scrutiny, and was again received back from the Executive Engineer not approved (*vide* copy of his letter No. 3011—519 M., dated 19th May 1916 attached). It was accordingly sent to the school authorities for further revision. The school authorities after this submitted the project for the third time to the Public Works Department. They did so direct to the Executive Engineer this time explaining to this office that they had done this to avoid delay. The Executive Engineer passed the project on to the Superintending Engineer who eventually reported on the 8th February 1917 that he was unable to pass it and suggested that the Director of Public Instruction should order a competent man to revise it before resubmitting it to the Public Works Department. He pointed out amongst other defects that the plans did not bear the signatures of the Collector, the Inspector or the Civil Surgeon (*vide* copy of his letter No. 1159—1107 C. B., dated the 8th February 1917 attached).

Copy of letter No. 17299—1107 C.B., dated the 18th December 1914, from H. S. Wildblood, Esq., M.I.C.E., Superintending Engineer, 1st Circle, Buildings and Roads Branch, Meerut, to this office.

Moradabad.—Proposed new building for the Coronation Hindu School at—

I have the honour to return the project for the proposed Coronation Hindu School at Moradabad, received with your letter No. 4100—II-15 (13), dated the 4th November 1914, and to make the following remarks:—

- (a) No calculations of foundations, R. S. Joists and iron trusses have been given, as they should have been.
- (b) No sections of trial pits are shown on the plan, these are essential to ascertain the depth of foundations.
- (c) The specification of the main building given at the back of the abstract of cost is incomplete and that of out-houses and well is not given.
- (d) The dimensions of the plan of the main building are incomplete in many respects and the positions of the R. S. Joists and trusses are not shown on the plan.
- (e) The long passages are in want of ventilation and light, and for this purpose sky-lights should be provided.

(f) No arrangement has apparently been made in the design for the roof-drainage of the passages. A slope of 1 in 36 or 1 in 40 should be given.

(g) *Khoa* has been provided over jack-arched roofs which is liable to cracks and leakage, $4\frac{1}{2}$ " concrete in lime should be used over jack-arches.

(h) No platform has been provided for the well. This is necessary for bathing purpose and for keeping water away from the well cylinder.

(i) Corrugated iron sheet roofing has been provided over the main hall of the school building, whereas double lock tiling would be better, though more expensive than the former.

(j) A provision of Rs. 306 has been made in the estimate for door chicks. Chicks should not be included in the estimate of the building.

(k) The rates given in the estimate are different for some items from the Public Works Department rates. The local rates of the Public Works Department should be adhered to unless strong reasons are given for not doing so.

(l) The odd verandah arches will not look well as designed.

Copy of letter No. 1159—1107 C.B., dated the 8th February 1917, from W. E. C. Belcher, Esq., Superintending Engineer, 1st Circle, Buildings and Roads Branch, Public Works Department, United Provinces, Meerut, to this office.

Copy of letter No. 3011—519 M., dated the 19th May 1916, from Mr. E. J. Wallace, Executive Engineer, Moradabad Provincial Division, Public Works Department, United Provinces, to this office.

I have the honour to return the project for the proposed Coronation Hindu School at Moradabad received with your No. F.—219—II-15 (4), dated 18th April 1916, with the following remarks:—

Coronation Hindu School, Moradabad.

With reference to your reminder No. F. 4128—II-15 (4), dated 9th January 1917, I have the honour to say I have had to return the project to the Executive Engineer again as I am unable to pass it.

1. There are several omissions and faults in design.
2. The sweepers' house, latrine and urinal as shown on the plan are not estimated for at all.
3. The project has not been signed by the Collector, or Inspector of Schools.
4. The site plan has not been countersigned by the Civil Surgeon.

5. Some items included in the estimate have not been shown in the drawings.

6. Ground level has not been shown so that the level of foundations cannot be fixed in this office.

7. The design of foundations and drain for out-houses is defective, as also that for the stairs, and tie rods have been omitted; these cannot be rectified by this office as insufficient information is given.

8. No report accompanies the estimate.

9. The design for the well is incomplete.

(2) I beg further to say that apparently this project has been under preparation for considerably over two years and apparently has been returned twice as it was not possible to pass it. The checking of such imperfect projects causes much unnecessary work in the offices of District Engineer and Executive Engineer and Superintending Engineer and it would save much time and trouble if projects were prepared by a competent man.

(3) I am quite willing to take some trouble in supplying missing details and rectifying small errors, but to go constantly carefully through estimates and designs of this sort is both irksome and wasteful and to supply all missing details and make corrections would take up more of my time than I can spare. I would suggest that you now order a competent man to revise the project before resubmitting to me.

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[Continued.]

- (a) No sections of trial pits are shown on the plan, these are essential to ascertain the depths of foundations.
- (b) The specification of the main building given at the back of estimate is still not clear and that of out-houses and well is not given.
- (c) Design of the servants' quarters is rather expensive. S. A. tiling instead of jack arches in roof can do well without court-yards as provided.
- (d) Details of turrets in front with calculation of foundation of the same should be given.
- (e) From the estimate it appears that the arches over doors and windows are 9" in height. But over doors and big windows they should not be less than 14" in height.

ANNEXURE III.

THOMASON CIVIL ENGINEERING COLLEGE,
ROORKEE.

INSPECTED ON NOVEMBER 16 AND 17, 1911.

Board of Inspectors.

The Hon'ble Mr. C. E. V. Goumont, M.I.C.E.
The Hon'ble Mr. C. F. de la Fosse, M.A.
Dr. E. G. Hill, D.Sc.

The work of the college is divided into two sides—professional and technical.

(1) *Professional*.—On this side there are the following classes:—civil engineering class, upper, and lower subordinate classes.

(2) *Technical*.—On this side there is the Department of Technology which is divided into (1) the higher division, (2) the lower division or mechanical apprentice class and (3) the automobile driver class.

The higher division at present contains only three or four students, but it is intended for twenty-five. The sections are (a) textile and (b) electrical and mechanical engineering. (See page 4 of the Annual Report of 1910-11.)

In addition to the inspection of these classes the Board visited the Photo-Mechanical Department and investigated the arrangements for the boarding and messing of all students.

The college is managed by a Committee consisting of eight members of which the Chief Engineer is president and the principal of the college is Secretary. The staff is a large one and, except in one or two subjects, adequate for the courses of instruction. Cases in which we consider that additions to the staff are desirable will be noted in dealing with the working of the departments concerned. Before passing on to remarks on the staff it would be well to consider the courses in the various classes.

(1) *The Civil Engineering class*.—The Chief Engineer went into the courses of this class very carefully with Captain Sandes, Professor of civil engineering. He is of opinion, and the Board agrees with him, that too little time is given to civil engineering in each year of the course. Thus, in the first term of the first year, no civil engineering at all is taught to students, although in general education they ought to be sufficiently advanced to begin the study of civil engineering at once. We were told that European students and some of the Indian students, when admitted to the college, are not up to the standard of education attained by the rest and that it is in consequence necessary in the first term to devote the time to unifying attainment, as far as possible. This is not satisfactory and it seems to the Board unfair to make some of the Indian students mark time after entering college while others make up ground. In the opinion of the Board the remedy for this state of affairs is to insist that all students should have reached approximately the same standard of education before they begin their courses in the college. This will enable them to compete at the college on a more equal footing.

We understand that it is especially the European students who are backward and their weak subjects are science and mathematics. The principal European

schools of these provinces are now being equipped with proper science laboratories and there should be no great difficulty in raising considerably the standard of attainment among European candidates in these two subjects.

In the second term of the first year, only three hours a week are given to civil engineering and, in the second and third years also the Board consider that more attention should be paid to this very important subject which it is the main business of the college to teach.

Not only is the time given to the teaching of this subject in college hours insufficient but the college text books of civil and sanitary engineering in all branches are antiquated and quite out of date. These need revision without delay, if this subject is to be taught as it should be. It may be noted here, for instance, that the text books do not even contain a description of such commonly known materials and modern methods of construction as reinforced concrete, wired brickwork, tar macadam and wood, stone, or asphalt paving of roadways, grill foundations, expanded metal and fibrous plaster ceilings, cooling, heating and ventilation of buildings. In the section on railways, the present system of interlocking signals and train control is not referred to and the article on aerial ropeways is very meagre. In the Irrigation Manual a more detailed treatment of tank irrigation and *bandhi* projects would be an improvement. The text books give numerous descriptions of existing works which though useful in their way should be relegated to an appendix. As compared with modern English text books, such as the Kensington series on building construction and Wood's theory of structures they are deficient in clear explanation of principles of design. There is also considerable repetition in the different sections, which seems quite unnecessary.

The subject of architecture, so important for every Civil Engineer, is not even touched. A detailed study of this subject is not necessary for an engineer but a few lectures to explain its first principles would be most useful to students and might be included in the class work of the college.

Sanitary engineering is hardly treated as an engineering subject at all. Lectures of an elementary type are delivered by the Professor of chemistry. This in our opinion is wrong. Sanitary engineering should be taken up thoroughly in the second term of the second year as an engineering subject. It should include hygiene, water-supply and drainage; and the Professor of chemistry should give lectures on chemistry as applied to this subject. There are no filter-beds in Roorkee and the nearest sewage works are at Bareilly. It would be an advantage if filter-beds and an installation for the biological disposal of sewage could be provided in connection with the sanitary arrangements of the institution to serve as object lessons to the students; and lectures might be given in class hours on the method of preparation of projects for water-works and drainage works of small towns to suit the different conditions which occur in practice.

If improvements are carried out in the courses and text books as suggested above, the extra work involved will make the duties of the Professor of civil engineering far too heavy and will necessitate the appointment of an assistant.

Passing from the engineering course to the other subjects studied by the civil engineering class, the Board is of opinion that too much time is given to surveying and drawing. The object of this class is not to turn out surveyors and draftsmen but civil engineers. A civil engineer should be able to survey and prepare drawings himself with moderate accuracy, but it is not essential that he should acquire a high standard of proficiency in the actual work of surveying and drawing by much practice while he is at college. A civil engineer student's time at college would be far more valuably spent in studying the theory of professional subjects, including surveying and drawing; and his practical work should be limited to what is actually necessary to impress the theory of the subjects he takes up firmly on his mind. The extra time given to civil engineering should be chiefly at the expense of these two subjects.

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[Continued.]

In mathematics there are so many classes in the college that the only way they can be dealt with is by taking two or more classes together for lecture purposes. Thus the technical class and engineering class are taken together. At present this does not result in very large numbers in these two classes, but the principle is objectionable. Even in the civil engineering class, as has been pointed out above, students join the college with a very unequal knowledge in these subjects, and it would be well if the teaching work could be organized not by years but in courses, say (a), (b) and (c) of graduated difficulty. This method would be more effective and simpler and more in accordance with English practice, but the real remedy lies in insisting upon all students actually attaining the preliminary standard required before their admission to the college.

In the subject of electrical engineering the course in electro-technics should, in our opinion, be somewhat more practical than it is. We recommend that a small project such as an installation for lighting the streets and dwelling houses of a small town should be introduced into the course of electrical engineering.

In addition to the above alterations in the text books and the courses of study the Board recommend that considerable changes should be made in the marks allotted to the various subjects throughout the work of the six terms. A higher value should be placed on the subjects of civil and sanitary engineering and applied mechanics by giving more marks for these in examination and less for such subjects as survey, drawing, physics and chemistry.

(2) Upper Subordinate class.

The same remarks apply to this class, *mutatis mutandis*, as those noted above in the case of the engineer class so far as relates to the value and study of civil engineering subjects. It should however be observed as regards this class that accuracy in drawing and surveying is relatively of greater importance for upper subordinates than for civil engineers and that it is therefore necessary to give more time to these two subjects in this class as compared with that devoted to civil engineering than is necessary or desirable in the engineer class.

(3) Lower Subordinate class.

In this class no changes are necessary in the time table, but the Board consider it desirable that more marks should be allotted to some of the engineering subjects and to practical work such as levelling, station survey and engineering practice.

New text books of a simple description should be prepared for this class. The present practice is to use the same text books on civil engineering for all classes from the engineer to the lower subordinate, certain chapters in each section being omitted for the lower class courses. This we consider is not satisfactory.

Technology.

Passing now to the *Department of Technology* the Board find themselves confronted with a serious problem. On the one hand in the higher division, there appears to be great difficulty in obtaining suitable students, while for the lower division (mechanical apprentice class and automobile driving class) the entrance qualifications are so low that the standard attained at the end of the course seems hardly enough to justify the retention of these classes in an institution with so highly qualified a staff as the Thomason College.

The Board feel that the higher class is at present in its infancy and consider therefore that it would be premature to propose any changes with regard to the courses already laid down. Much will depend upon the material which this class attracts in the next two or three years.

In the case of the mechanical apprentices' or foremen's class, the first and second year students are taught by an Indian instructor in the vernacular, owing to their inability to follow English as a spoken language. This instructor teaches them a little elementary mechanics, some engineering, a little carpentry and a few general

subjects. In the second year they are still so weak as to need explanations in the vernacular. These students are not competing for government employment and they entirely lack the sense of responsibility attaching to students of the engineering classes, who may be given a certain amount of liberty and as a rule work steadily and honestly. We were told that the mechanical apprentices are inclined to shirk work and need strict discipline. They cannot in any sense be said to fit in with the life of the college and their presence tends to lower the tone of the institution and to render the maintenance of a proper academic atmosphere well nigh impossible.

In the opinion of the Board these classes should be transferred to Lucknow and Gorakhpur. In these two towns there are railway workshops and there should be little difficulty in finding employment for students of the type in question. Or to put the case in another way, it would be easy for these centres to provide exactly the course of instruction required to turn out the man required by employers of labour. The principal admits that the qualifications of the mechanical apprentices are very low on admission, but he hopes to develop the class and get better men later on, so as to make the course in this class equivalent to that of the upper subordinate class on the civil engineering side. In that case he holds that workshop training could not be given with the equipment of an industrial school, and he says that he finds no difficulty in securing suitable situations for the men he is now turning out, poorly educated though they may be. In answer to this it is only necessary to remark that he has proved the existence of a demand for men of the present stamp, and that if he aims at turning out men of a much higher stamp his argument does not meet the objection taken to the retention at the Roorkee College of a mechanical apprentice or foreman class. There can be no doubt that the men at present recruited, being, as regards education, very poor material, cannot follow the prescribed text books, which are too advanced for them and are moreover written in English, or pursue the course of studies laid down for the class, since it is far too difficult for them. The question to be considered is whether it is justifiable to continue to burden the college staff with the instruction of a class that is not up to the standard laid down, in the hope of ultimately attracting a higher class of students and turning out a quite different product. The Board consider that as at present constituted the work done in this class is likely to overlap that being done in the Industrial classes at Lucknow and Gorakhpur, while, if the principal's object be attained, it will overlap that of the higher technological students. The difficulty already experienced in attracting students to this higher class, the entrance standard of which has recently been lowered with a none too promising numerical result, needs to be borne in mind in this connection. In that class at present there are only four students and of these one is so much weaker than the other three that he cannot be taught along with them in all subjects. It cannot therefore be said that there is much ground at present for indulging in the hope that the mechanical apprentice class will develop in the way in which the principal anticipates.

The Automobile Driver class.

There seems to be no longer any reason why this class should be retained in Roorkee. Such a class can be perfectly well taught in Lucknow and the type of students undergoing instruction is one which it is undesirable to have in the same institution as that which trains engineers.

INSTRUCTIVE STAFF.

A list of the gazetted and non-gazetted teaching staff of the college is given in appendix A.

The system of organization of work in the college is as follows:—The senior professor in each subject is responsible for the whole of the work in his subject throughout the college. Thus the professor who teaches mathematics to the engineering first-year and second-year class and the technical class is also responsible for the mathematical teaching given by the mathematical instructor to the

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[Continued.]

upper subordinate class. In a somewhat lesser degree he is also responsible for the work in the subordinate and mechanical apprentice classes. His difficulties in arranging the work of so many classes and exercising control over them are greatly increased by the inequality in mathematical attainment of men admitted even to the same class. The arrangement of the work is open to certain obvious objections, among which may be instanced the doubling up of classes, which leads to complications such as that which will be met with when the present technical class is in its second year. A better method would be perhaps to reclassify the students according to proficiency; but the situation would be much improved if some of the lower classes, as already suggested, were abolished. At any rate some simplification of the organization seems imperative. In illustration of the complications it may be mentioned that the mechanical apprentice class has so limited a knowledge of English that teaching in mathematics has to be imparted to it in the vernacular.

At present it appears possible for changes in a course taught by an instructor to be introduced without reference to the senior professor. It would facilitate co-ordination if a department, like the mathematical, drew up a general syllabus of work. Then proposals for revising the course of a particular class could be considered in connection with the work of other classes and of the department as a whole.

The instructive staff or equipment may now be considered in more detail—

Department of Civil Engineering.

The subjects taught by the Professor of civil engineering, Captain Sandes, are as follows:—

- (a) Materials.
- (b) Earthwork.
- (c) Carpentry.
- (d) Masonry.
- (e) Building construction.
- (f) Roads and tunnels.
- (g) Bridges.
- (h) Railways.
- (i) Water-supply.
- (j) Irrigation.

Sanitary engineering is taught by the Professor of chemistry; accounts by the Superintendent of the office.

The Board has already recommended a considerable extension of the time given to civil engineering and that the subject of sanitary engineering should be taught by an engineer. These changes necessitate some addition to the staff in the Civil Engineering Department. It is probable that more than one extra teacher will be required on this account, but one extra instructor is an urgent necessity. Captain Sandes wishes to bring the models in the model room up to date, and this should be done at once, as models are extremely useful for the instruction of Engineer students. To bring this model room up to date will involve a great deal of work and for this an assistant will be required, whose duty it should also be to help in demonstrations.

The upper subordinate class in this department is under Mr. Brining who teaches all the civil engineering subjects. In this class also we have recommended a considerable addition to the amount of civil engineering and here also an assistant will be necessary.

The lower subordinate class calls for no special comment.

Accounts in each of the three engineering classes are taken by the Superintendent of the office. The arrangement seems satisfactory.

Department of Mechanical Engineering.

The course in this subject for the Civil Engineering class is well arranged. The lectures are delivered by Mr. Jordan, Professor of mechanical engineering. In practical work he is assisted by Mr. McLean and Mr. McLaren. The latter also lectures to the mechanical engineering classes on heat engines and exercises a

general supervision over the workshop courses. Mr. McLean lectures on descriptive engineering and takes the theory of machines with the mechanical apprentice, upper subordinate and civil engineering classes. He also takes drawing with the mechanical apprentice class. Mr. Rayner, the second European assistant, takes design and drawing with the electrical and mechanical class and tutorial engineering with the mechanical apprentice class. In addition to the above European instructors there is an Indian instructor for the mechanical apprentice class who teaches mechanics, physics, mathematics and drawing.

The textile class is at present in abeyance. Mr. Cullen has resigned his appointment and his successor has not yet been appointed.

Department of Electrical Engineering and Physics.

The laboratory of the Professor of electrical engineering is not large enough to accommodate all the students reading in some of the classes, consequently, for practical work, the classes are frequently sub-divided. This is not a serious defect. In fact, if suitable arrangements for sub-division can be made in the time table, it might be actually an advantage, since the sub-division will secure that each student obtains a larger amount of personal attention from the professor. In the professor's view the store room accommodation is inadequate. One of the rooms is too dark and inconvenient and the other one too small. A *mistri* is required in the workshop attached to this laboratory and the need of one will be more keenly felt when the technological classes are larger. The professor's duties are to take electricity and magnetism in electrical engineering with the civil engineering class and electro-technics with the technological classes in the second and third years. A demonstrator in electrical engineering has been recently appointed. His duties will be to arrange the laboratory and help in the supervision of the practical work. He will also have charge of the maintenance and repair of the electrical plant and assist in clerical work. In addition to the above duties the Professor of electrical engineering, who is a member of the Indian Educational Service, is in general charge of the whole department.

The duties of the Professor of physics are to teach the first year of the civil engineering and technological classes and to teach elementary science to the first year upper subordinate class. In addition to this he takes a course in theoretical and practical physics in the second year mechanical apprentice class and in the electrical engineering with the third year of the mechanical apprentice class. In this work he is assisted by a demonstrator whose work corresponds with that of the demonstrator in the electrical engineering class. In this department the two important courses of electro-technics to the second and third year of the technical class are at present in abeyance, as there are no second and third year students in the college. When these classes are full it would probably be necessary to modify the distribution of work, especially if, as we have suggested above, a project of electrical engineering is to be introduced into the course.

Department of Chemistry.

The laboratory is adequate and well equipped. The Board notes, however, that the Professor of chemistry has hitherto been responsible for a course in sanitary engineering which consisted entirely of lecture work. This class should be handed over to the Civil Engineering Department, and the Professor of chemistry should give lectures and practical instruction in chemistry only as applied to sanitary engineering. The professor's subjects in addition to these are elementary inorganic chemistry, inorganic chemistry in reference to textiles and geology, mineralogy and chemistry applied to engineering materials.

The subject of geology and mineralogy is one for a specialist. It so happens that the present incumbent of the post of Professor of chemistry is well qualified to teach these subjects, but during his absence on leave it

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would be very difficult to provide a lecturer. In our opinion it would be wise to appoint a demonstrator in geology. Since the teaching of this subject would not probably occupy the whole of his time he might be required to give a portion of it to laboratory work with practical classes.

Business department.

At present this consists of the Photo-Mechanical Department. The printing department has already been removed. We understand that the Principal would be averse from removing this department from the college, but it is really a business concern and outside the scope of the college work. Much of the work undertaken is for the Survey of India, and there seems to be no reason why it should not be removed and placed under the control of the Survey Department. It is understood, moreover, that the School of Arts and Crafts will take up the subject.

General.

In the first year of the upper subordinate class there are forty-three students of whom two-thirds are Punjabis. It is disappointing that not more students come from the United Provinces, and it might perhaps be worth while to make an endeavour to ascertain the reason.

Discipline.

The system of maintaining discipline in the college is best described by the following extract from a staff circular issued by the principal :—

"Each class is placed under an officer in charge of the class who will report to the principal all disciplinary measures he considers necessary. He will be in charge of the mess, games and recreation funds of his class."

Engineer class	Captain Sandes, R.E.
Department of Technology, higher division.	Mr. F. Sedgwick.
Upper subordinate class	Mr. Brining.
Lower ditto	Salyid Abdul Hasib.
Department of Technology, mechanical apprentice class and automobile driver class.	Mr. Jordan.

Professors will report direct to the principal.

The following is the arrangement for maintaining discipline out of college :—

"Discipline in barracks.

Engineer class	Captain Sandes, R.E.
Upper subordinate class	Mr. Brining, Personal Assistant.

All other Indian students will be directly under the principal with the following chain of responsibility :—

General.

Personal Assistant	Mr. Tripp.
Indian Superintendent of Barracks	Sardar Natha Singh.
Barrack Superintendent No. 20	Mr. Jaffar Ali.
Barrack Superintendent No. 6	B. Puman Ram.
Barrack Superintendent No. 7	S. Natha Singh.
Barrack Superintendent No. 8	B. Ram Sahai.
Barrack Superintendent No. 11	S. Natha Singh.
Barrack Superintendent No. 16	M. A. Sattar Khan.
Barrack Superintendent No. 18	M. Abdul Hasib.
Barrack Superintendent No. 19	S. Kishan Singh.
Barrack Superintendent No. 65	S. Kishan Singh.
Barrack Superintendent No. 5	Mr. P. C. Sen Gupta.

The above officers will be entirely responsible for the welfare and discipline of the students under them."

These arrangements seem to be convenient and to work well, though it is perhaps a pity that the European staff does not come more into contact with students out of college hours.

The water-tight hostel organization and the number and varying grades of attainment and social position among the students render corporate life out of the question. Each class lives its own life out of college hours apart from the rest; and while the highest class imitates in its messing arrangements the style of an officers' mess, the lowest lives after the manner of humble vernacular school students. Free intercourse is in the circumstances impossible. It is no wonder then that there is a strongly marked tendency among the students themselves towards division; and it was mentioned in illustration of it that the engineering class had recently decided that they could not admit the students of the technical class to play games with them.

The Board is given to understand that in the interests of the public service it is not considered advisable that members of the engineering class should mix too freely with the students of lower classes from which subordinate officers of the same service are recruited. To this necessity—if such it really be—the social life of the college is inevitably sacrificed. As boys they have been brought up together at the same schools and they come from the same class of homes. But regrettable as such a state of things must be from other points of view, it is now probably too strong a tradition of the place that a higher class shall not mix with that of a lower status to make it advisable to endeavour to alter it. Indeed so long as there are classes of the standing of the mechanical apprentice class, it would be too much to expect collective

life. Its absence, however, is a misfortune in the case of the younger students in particular, since it deprives them of the valuable influence of common social intercourse in the building up of character. The Thomason Engineering College does not in this respect compare favourably with an ordinary Arts college.

C. E. V. GOVMENT.

The European civil engineering class appears to be dwindling in numbers and the hostel intended for this class which contains excellent accommodation is more than half empty. It seems a great pity that this fine building cannot be used for some of the European members of the upper subordinate classes. The upper floor might be reserved for engineers and the lower for upper subordinates. Hostels for the other students are arranged in blocks. These are of an old-fashioned type and the general plan is to place three students in each room. The better class of Indian students appear to wish for bathrooms attached to the living rooms, but the Board cannot for sanitary reasons recommend this plan for adoption. The hostel blocks are all built with a low plinth and it would be a great mistake to make any alterations which would tend to render the rooms damp or affect their proper ventilation.

Something more might be done in the way of systematic roll-calls at night to ensure students being present in barracks after sunset, since owing to the way in which the hostels are constructed there are no physical obstacles in the college grounds to students getting out at night.

In conclusion the Board of Inspectors would like to put on record their appreciation of the readiness of one and all from the principal downwards to afford assistance and information, and of their recognition of the way in which the staff is devoting itself to its duties. They were struck by the high sense of responsibility of the professors for the work in their several departments and with the tone of professional zeal and earnestness prevailing throughout.

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List of professors and teachers with academic qualifications.

Number.	Names.	Designations and pay.	Academic qualifications.
1	E. F. Tipple, Esq.	Professor of mathematics and physical science, Rs. 750—50—1,000.	B. A. (Cantab).
2	F. W. Sedgwick, Esq.	Professor of electrical engineering and natural science, Rs. 750—50—1,000.	M.A. (Cantab), A.M.I.E.E. One year apprentice, Gulchar Electrical Light and Power Company. Six months Assistant Engineer, Gulchar Electrical Light and Power Company. One year and six months Assistant Engineer, Elliot Brothers, instrument makers. Two years lecturer in electrical engineering, Sheffield Technical College.
3	Captain E. W. C. Sanders, R.E.	Professor, civil engineering, Rs. 600—20—700, Military pay Rs. 140.	R. E. officer.
4	Dr. P. P. Phillips	Professor, Chemistry, Rs. 600—50—1,000 .	Ph. D. (Göttingen), F.C.S.
5	C. J. Veale, Esq.	Professor, Drawing and surveying, Rs. 600—50—600.	Passed Survey of India examination.
6	H. T. Jordan, Esq.	Professor, Mechanical engineering, Rs. 650—50—1,000.	M.Sc. (Manchester), member of the German Society of Engineers.
7	Conductor F. W. Hart	Instructor, A. S. Department, and Superintendent, Press, Rs. 400—20—500. Allowance Rs. 100.	Passed as Sub-Engineer. Has had a good deal of training in photo-mechanical work in England while on furlough.
8	W. D. McLaren, Esq.	Instructor in mechanics, steam and heat, Rs. 500—50—750.	A.M.I.E.E. and A.M.I.M.E. Diploma in mechanical engineering. Herriot Watt College, Edinburgh.
9	Sub-Conductor F. A. Pringle	Head Master, U. S. Class, Rs. 300—15—400	Passed as Sub-Engineer. Otterlein University.
10	F. J. Smith, Esq.	Instructor in drawing, Rs. 250—15—400 .	Passed as Sub-Engineer.
11	Sub-Conductor C. E. W. Wilkins	1st Assistant Master, U. S. Class, Rs. 200—10—300.	Passed as Sub-Engineer.
12	Sub-Conductor J. S. Gurney	2nd Assistant Master, U. S. Class, Rs. 200—10—250.	Passed as Sub-Engineer, F. S. I., M. R. S. I.
13	A. M. McLean, Esq.	1st European Assistant Instructor in mechanical steam and heat, Rs. 300—20—400.	Glasgow and West of Scotland Technological College, Member of Institute of Engineers and Ship-builders, Scotland.
14	A. J. Rayner, Esq.	2nd European Assistant Instructor in mechanical steam and heat, Rs. 200—10—300.	A.M.I.E.E., A.M.I.M.E.
15	J. Cullen, Esq.	Instructor in cotton spinning and machinery, Rs. 500—40—700.	A.M.I.M.E. Holds Cotton spinning certificate of City and Guilds of the London Institute.
16	T. C. O'Neill, Esq.	Instructor A. D. Class, Rs. 200—10—250 .	Mechanical and electrical engineer.
17	H. M. Mukerjee, Esq.	Indian Professor of physics, Rs. 200—20—400.	B. A. Allahabad University.

Non-Gazetted Teaching Staff.

1	H. J. L. Grogan, Esq.	Instructor in accounts (Superintendent office), (Rs. 40—4—60) (Rs. 100—10—210).	L. C. E. of the College of Science, Poona.
2	Mr. J. G. Mitra	Demonstrator, Chemistry Rs. 200 . . .	B.Sc. of the Allahabad University.
3	Mr. P. Chakravarty.	Ditto Mathematics Rs. 120—5—150.	M.Sc. of the Allahabad University.
4	Mr. Anand Swarup	Ditto Physics Rs. 100—5—120 . . .	B.Sc. of the Allahabad University.
5	Mr. P. C. Sen Gupta	Ditto Mathematics Rs. 120 . . .	B.Sc. of the Allahabad University.
6	S. Abdul Halib	Head Master, L. S. Class, Rs. 120—5—150	Passed as Sub-overseer.
7	S. Natha Singh	1st Assistant Master, Rs. 100—4—120 .	Failed in B.A. examination. Holds senior certificate of Lahore Training College. Attended drawing and carpentry class School of Arts, Amritsar, and read for some time in the civil engineering class of the Thomson College.
8	M. Mawa Lal Munshi	Demonstrator, electrical engineering technical class, 2 years on works at Patiala.	
9	L. Ram Sahai	2nd Assistant Master, Rs. 80—4—100 .	Passed as sub-overseer and earlier Sub-Engineer examination. Read up to First Arts.
10	L. Pritam Das	3rd Assistant Master, Rs. 70—2—80 . .	Passed as sub-overseer.
11	L. Phuman Ram	4th Assistant Master, Rs. 60—2—70 . .	Passed University entrance examination. Passed as sub-overseer and outsider Sub-Engineer.
12	M. Abdul Sattar Khan	5th Assistant Master, Rs. 50—2—60 . .	Passed as sub-overseer.
13	S. Kishen Singh	Indian Assistant Instructor in mechanical steam and heat, Rs. 100—10—150.	Passed mechanical apprentice class of this College. Holds 1st grade engine driver certificate.
14	P. Raghunandan Lal	Instructor, Industrial Class, Rs. 50—1—40	Passed sub-overseer.

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[Continued.]

ANNEXURE IV.

Whereas the Director of Public Instruction, on behalf of His Majesty's Secretary of State for India in Council, has arranged with Messrs. _____ for the responsibility for the construction of a high school at _____ it is hereby agreed

(1) that the work shall be carried out strictly in accordance with the plans and specifications hereto annexed;

(2) that the total sum to be paid by the Director of Public Instruction for the work, including the clearing of the site and removal of the debris after construction shall be Rs. _____ provided:

(a) that in the event of there being any substantial savings owing to the work having cost less than the sum shown in the estimate hereto annexed, the amount of such savings may be deducted by the Director of Public Instruction from the above sum of Rs. _____

(b) that in the event of some unforeseen contingency adding substantially to the compulsory expenditure the Director of Public Instruction shall pay such sum over and above the sum of Rs. _____ and may if he should think necessary obtain the opinion of the Superintending Engineer of the Circle to the reasonableness of the increased cost;

(c) that in the event of the work not being completed within _____ months from the date of execution of this agreement the Director of Public Instruction shall be entitled to deduct from the above sum of Rs. _____ such amount as he may consider having regard to all the circumstances to be reasonable;

(3) that payment shall be made by the Director of Public Instruction at such monthly rate in proportion to the amount of work completed as he may consider reasonable. Such payments will be on account until the final bill is paid on completion of the work;

(4) that the final payment will be made within three months of the date on which the building is formally handed over to the Director of Public Instruction;

(5) that the Director of Public Instruction shall be entitled to have the work inspected and examined during the course of construction by such person as he may appoint to act on his behalf;

(6) that in the event of any failure in respect of condition I of this agreement the Director of Public Instruction shall be entitled to deduct from the above-mentioned sum of Rs. _____

such sum as he may consider fit and reasonable; provided that if Messrs. _____

so require, the matter shall be referred to the Superintending Engineer whose decision shall be binding on both parties.

(1) _____

Signature.

Witnesses

(2)

Witnesses (1) _____

(2) _____

Director of Public Instruction,
United Provinces.

Accepted by Government on behalf of His Majesty's Secretary of State for India in Council.

Secretary to Government, United Provinces,
Education Department.

The Hon'ble Mr. C. F. DE LA FOSSE called and examined.

3,876. (President.) The witness stated that he was the Director of Public Instruction, United Provinces, and that he was in charge of the Education Department of the local Government.

3,877. In connection with the remark in his written evidence to the effect that he had been informed that contractors carried out work more cheaply in the absence of Public Works Department scrutiny and supervision, his attention was drawn to certain instances which had been put forward in evidence where private bodies, even in regard to educational buildings, had employed the Public Works Department rather than private contractors. He thought such instances were largely due to the fact that the private managing committees concerned had not a competent supervising agency of their own, and added that in those cases in which government had been willing to meet a considerable share of the expenditure entailed, such committees had generally preferred the supervision of the Public Works Department because the cost they themselves had actually to meet was not thereby increased. He admitted, however, that the committee of management for the Hewett Khatrinya School, Benares, which institution had been created entirely from private subscriptions, had spontaneously sought the assistance of the Public Works Department for its construction, but remarked that the case was exceptional as the committee, of which he was a member, contained several officials and was presided over by the Commissioner of the division. It was the only one of which he was cognisant. The case of the Harish Chandra High School was then put to him, but he stated that this school had been erected under a certain Commissioner who was president of the school committee, and who had deemed it expedient that the building should be supervised by the Public Works Department. Though it was a private enterprise in that the funds other than the grant-in-aid had been mostly furnished by the late Raja of Bhingha, government assistance had been given during construction on the advice of a government

officer. He added that unless private educational bodies were assisted by considerable government grants, they did not invoke the aid of the Public Works Department.

3,878. The prescribed procedure in respect to the erection of educational buildings for which government grants had been given was as follows. The plans and estimates had to be approved by the Public Works Department prior to the fixation of the amount of the government grant-in-aid. After this amount had been fixed, private contractors were engaged to construct the school, or other educational building, and the building had to be examined by officers of the Public Works Department at certain stages of construction. At least three inspections were usually undertaken by the Public Works Department, the first when the foundations had been dug, the second just before the roof was put on and the third on the completion of construction. After their last inspection, the Public Works Department officers furnished the Director of Public Instruction with a completion certificate, on receipt of which that officer paid the grant. He remarked, however, that this procedure had not always been followed. The procedure in regard to payments of grants, the examination of plans and estimates and the supervision of buildings for which government grants were given was laid down in the Educational Code.

3,879. It had been his personal experience that managing committees, even in instances in which a government grant-in-aid was given them, did not, as a rule, utilize the services of the Public Works Department for the preparation of designs or construction. He added that ordinarily committees, in cases where they experienced difficulty in raising the necessary funds from private sources, hesitated to utilize the services of the Public Works Department owing to the fear that such a course might involve them in greater expense.

3,880. No charge was made by the Public Works Department for the inspections conducted by their officers. He surmised that a charge would ordinarily

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be made in cases in which the Public Works Department undertook actual construction, but remarked that in some instances government had allowed a committee to utilize the services of the Department and waived the charge, e.g., in the case of the University of Allahabad. A large number of contribution works were constructed free of charge for supervision and tools by the Public Works Department on behalf of the Department of Education, but he disapproved of this system, as he thought it had a tendency to stifle private enterprise, and had probably resulted in bad accounting. In spite of the fact that the system in question might be advantageous from the educational point of view in that it admitted of educational buildings being constructed more economically, he did not think it was suitable. He was of opinion that it would be easier to persuade government to sanction a charge for supervision being waived than it would be to induce it to allot equivalent amounts to cover such charges, but he had not had occasion to test this contention.

3,881. The reason why the Department of Education had entered into a contract with a certain large private firm of consulting engineers in the United Provinces for the construction of several school buildings was because the Public Works Department were not in a position to carry out the large quantity of work that was involved as expeditiously as was required by the Education Department. Under the terms of the contract the firm designed each building, drew up the estimate, added 10 per cent. to their charges for supervision and were ultimately responsible for handing over the building complete to the Department of Education. After designs had been prepared by this firm they were examined by the local Educational Inspector and then passed on to the Director of Public Instruction. This officer checked them in order to see that the requirements of the Education Department had been met and passed them on to the Educational Secretary in the local Secretariat. From the Educational Secretary they went to the Chief Engineer and were examined from a professional point of view in the office of the latter. The designs were then sent back to the firm with such comments as the Chief Engineer might have made on them, and after the criticisms had been met the firm were instructed to start construction. Though the designs prepared by the firm were subject to professional approval, in that both the designs and estimates had to be passed by the Chief Engineer, that officer did not alter either but merely criticised them. The buildings erected by the firm had in one or two instances been subject to Public Works Department inspection, but definite rules had recently been framed, similar to those in the Educational Code that related to the construction of state-aided buildings by private bodies, under which the construction of buildings by the firm would be subject to three inspections.

3,882. There was a condition in each contract entered into with the firm which insured the stability of the building. Under this each building had to be passed as satisfactory before it was made over to the Department of Education, and in some cases Superintending Engineers, had furnished the requisite certificate. Questioned as to how they had done so when they had not seen the buildings in course of construction, he replied by naming two officers who had seen in one case the Gorakhpur school, and in the other the Muzaffarnagar school, in progress and mentioned that when the Superintending Engineer saw the former institution he had made certain comments on the work.

3,883. Under the contract entered into with the private firm, the firm was responsible for the execution of the work on behalf of the Department of Education. It probably employed contractors to undertake actual construction on its behalf, but the Department did not enter into relations with any of the contractors and merely looked to the firm to meet their requirements.

3,884. Advances had been made to the firm on bills relating to the purchase of girders, bricks, employment of labour, etc., some of which were submitted by the firm before construction, and some on bills submitted during the progress of work, final bills being submitted on

the completion of each work. He admitted that as a result most of the funds had in the majority of cases been advanced to the firm by the end of the financial year, and that in some instances the buildings concerned had not as yet been made over to the Education Department, though the funds therefor had been advanced during the previous year, and explained that the greater part of the funds had been paid during the course of the year by allotments to the firm on bills sent in by it, and that the local Government had instructed him to pay the whole amount towards the close of the financial year in order that the sums concerned might not reappear in the following year's budget. In most cases, however, payments which had been made related to actual work performed. Hence, though it was true that the firm had had the advantage of a large supply of capital considerably in advance of their actual work, it was the result of a desire on the part of government to avoid the reappearance of the sums concerned in the following year's budget and could not be taken to be an unbusinesslike procedure on the part of the Department of Education.

3,885. Though a time-limit had been fixed in each of the contracts entered into with the firm, none of these time-limits had been insisted on owing to the difficulties which had been experienced by it during the past year in procuring girders, etc., and labour. Seasonal difficulties also had interfered with the progress of each work, and the time taken was consequently longer than the firm had anticipated. The difficulties in respect to labour and cost of materials were chiefly due to the war and were not existent at the time that the several contracts were entered into. He was unable to say whether any of the contracts were entered into previous to the war, but when his attention was drawn to one for which the time-limit fixed was a date in February 1916, he remarked that the Education Department had had no experience at the time they entered into that particular contract as to what would be the actual time occupied in the erection of the building. Further that the firm had subsequently found that the contract they had entered into was one which could not be adhered to and had asked for an extension. He had not compelled the firm to abide by their contract, nor had he enforced on the firm the penalty that that contract contained, as he was anxious to gain experience of working with private agency, and to ascertain the length of time required for the construction of buildings.

3,886. The dates he had furnished in the comparative statement attached to his written evidence relating to works constructed by the Public Works Department were the dates on which each of the projects had been originally initiated, i.e., each date was the one on which the Public Works Department were requested to prepare a plan and estimate for administrative sanction, and it included the period occupied in obtaining administrative sanction. To the contention that in the corresponding statement relating to works given to a private firm these dates did not include this period, he replied that the procedure followed in the case of the Public Works Department was different to that observed in the case of the firm, in that the firm set to work immediately after it prepared the plans, and there had hence been no delay. He admitted however that his comparison was not a fair one as a portion of the period in the case of buildings erected by the Public Works Department might include the time that had been taken up in the Secretariats of the local Government, in dealing with the estimates, but remarked that he had made a statement to this effect in his written evidence.

3,887. Private bodies had great difficulty in preparing designs that met with the approval of the Public Works Department. There was no system in the United Provinces, such as obtained in several other provinces, under which an educational authority might have a design prepared for a school on the submission of a requisition to the Public Works Department either on payment of a charge of 2½ per cent. or free of charge, but government would probably have no objection to the introduction of such a system in the United Provinces subject to the

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obtaining of their sanction in each case. If private bodies were permitted to apply direct to the Public Works Department for assistance it would be difficult for the latter to undertake works that were located in out-of-the-way places. To illustrate his contention that private bodies had experienced difficulty in this respect he cited a recent case in which the Bishop of Lucknow had not been able to secure the assistance of the Public Works Department in connection with a European school at Meerut and had been obliged to employ a private firm from Allahabad. It would be an improvement if a rule were framed under which an educational body might requisition the services of the Public Works Department for the preparation of designs and estimates subject to the payment by that body of a fee. A rule on the subject was here indicated to him, but he pointed out that the private body were not given authority under that rule to requisition the Public Works Department since the rule made it merely permissive on the part of the latter to refuse or accept a request. He surmised that at the time of the Bishop of Lucknow's request the Public Works Department officers who were approached were too much occupied with their own work to be able to comply with the request, and added that as a matter of fact the services of the Public Works Department were not often utilized by private bodies for the preparation of plans and estimates.

3,888. In certain places, e.g., Saharanpur, it was difficult for private bodies to have their designs prepared by private agency because of the absence of competent firms, and it depended on the value of a building whether a private committee in an out-of-the-way place would consider it advisable to procure an architect from Lucknow or Allahabad. It would hardly be worth while to send to Lucknow for an architect if a school were erecting a building worth about Rs. 15,000 or Rs. 20,000, as the cost of the architect's railway travelling would greatly add to the cost of the building. Architecture was very little developed in the province and there were only about three or four firms which were capable of designing buildings to the satisfaction of the Public Works Department.

3,889. In connection with a suggestion that the several departments might be made responsible for the maintenance and repair of the buildings each occupied, he remarked that, in so far as the educational buildings that had been given out for construction to the private firm previously referred to were concerned, it might be advisable to leave the repair work in the hands of the firm. The firm had expressed its willingness to undertake repair work at $1\frac{1}{2}$ per cent. on the capital cost of each building and he anticipated that great advantage would accrue from the adoption of such a course, as the firm could then be required to remove any defects that might come to light after the buildings had been constructed. The firm would have to take into consideration that defects were due to its faulty workmanship, and this would induce it to keep buildings in proper order, and to obviate losses consequent on allowing buildings to fall into a state of disrepair it would probably undertake repairs that were needed promptly. A system under which the Department of Education might undertake repairs itself, though workable, would be both advantageous and disadvantageous. It would be advantageous in that the repairs would be carried out promptly and that the officer in charge of the building would be interested in seeing that they were done well, but on the other hand it might happen that expert knowledge was necessary to carry out particular repairs, and in such cases the officer on the spot might not be competent to judge whether a work had been properly executed or not. He did not agree, however, that the fact that the building trades were not sufficiently developed in some parts of India to allow of repairs being carried out, as in England, by job builders without the aid of professional opinion constituted a serious objection, since educational buildings were mainly situated at the headquarters of districts where pucca houses were common and where there was, as a rule, a considerable amount of work in progress. Job builders, he considered, must exist in all headquarters of districts, and he did not think there would be any

serious difficulty in introducing the system proposed. It could not be contended that the proposed system would absorb an undue amount of the time of a non-professional man to the detriment of that individual's ordinary work. On the contrary, headmasters would, as a rule, be quite willing to undertake to superintend repairs to their respective school buildings, and such additional duties would not occupy a great deal of their time. Primary schools in the United Provinces were under the district boards, but there were secondary English schools at the headquarters of nearly all districts, maintained by government, and these latter were the buildings with which his Department was mainly concerned. In addition there was the government college at Allahabad and training colleges and technical schools. He thought that the proposed system might be tried in the case of secondary schools, but agreed that it would perhaps be better not to extend the system to larger institutions, e.g., to colleges.

3,890. The criticism that heads of departments, etc., requisitioned the Public Works Department for the preparation of an enormous number of plans and estimates for works for which funds were not available could not, he thought, be applied to the Education Department. He had not in his office plans and estimates which had been prepared by the Public Works Department for projects that involved lakhs of rupees and which had been held up for want of funds. On the contrary, funds that were allotted for works relating to his department often lapsed because the department were not able to get the plans prepared by the Public Works Department in time. There was a rule which prohibited his requesting the Public Works Department to prepare plans and estimates unless he was in a position to state definitely that there was a probability of funds being available for the work, and he generally asked the Public Works Department to prepare plans and estimates one year in advance.

3,891. In respect to the Public Works Department contention that requisitioning departments never specified their requirements in sufficient detail with the result that occasionally two, three or even four sets of plans had to be prepared for a particular building, he remarked that this could not occur in his department as educational buildings were erected on standard designs. The Public Works Department had some years previously drawn up a set of standard designs for high schools, vernacular middle schools, primary schools, etc., and these designs were the basis on which plans and estimates for educational buildings were prepared. He would not permit an individual education officer to vary designs according to his views or an Inspector to alter a design, and the criticism by the Public Works Department that had been put to him could not be applied to the Department of Education.

3,892. The Roorkee College, although manned by educational officers and nominally an educational institution, had not been under the Department of Education since 1900. In that year a new department had been created as a branch of the Financial Secretariat of the local Government and designated the "Industries Department." Though the Chief Engineer of the Public Works Department was the president of the committee, questions relating to Roorkee were settled in the Industries Department. Hence, the College, if it was under any Department, was at present under the Department of Industries. He had obtained his present appointment only in 1909, and hence did not know whether this college had ever been under the Education Department. As far as he was aware the principal of the College had always corresponded with government direct, either with the Chief Engineer in the Buildings and Roads Branch of the Public Works Department, or with the Industries Department. The institution had consequently never been really an educational institution in the sense that certain other colleges in the province were.

3,893. The Director of Public Instruction was a member of the committee of management that administered the Roorkee College and the budget of that institution was, for administrative reasons, passed through the Education Department. The Director of Public Instruc-

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tion had also the power to grant casual leave to the principal of that College, but as far as he knew there were no other functions that he performed in connection with the college in his capacity as principal. He had no real financial control over the College budget, but merely checked it with a view to noting any increase or decrease in expenditure, and when explanations furnished by the principal were insufficient he asked that officer for further information in order that he might be able to lay the facts before government as clearly as possible.

3,891. It would not make much difference if the Roorkee College were placed directly under the Department of Education. He did not think the Director of Public Instruction, as such, should be empowered to interfere in the framing of the courses of instruction or in the administration of so special an institution as the college. But he recommended that the professors of the college might be given a larger voice in the framing of the courses of instruction and that the educational aspect of the work in the college might be more considered than it was as present.

3,893. The bulk of the professorial staff employed in the Roorkee College was recruited by the Secretary of State to the Indian Educational Service, but, as members of that service, they were not subject to his control. Though cases relating to the filling up of leave vacancies in the staff were as a rule passed through him, what usually happened was that the principal communicated with the Chief Engineer, who circulated the papers among the several members of the committee, with suggestions for filling up of the vacancy. This system, he thought, worked well and he did not desire any alteration to be made in it. The only alteration he recommended in connection with the administration of Roorkee was the constitution of a Board of Studies empowered to settle the curricula of the college, and to this he attached much importance.

3,896. The age-limit of 21 that had been fixed for admission to Roorkee was in his opinion too high, and he suggested that it might be lowered to 18. He remarked in this connection that a committee had been appointed some years previously to consider the standard of general education necessary for admission to Roorkee, that this committee drew up a course of studies for an examination which was about equal in severity to the intermediate arts standard of an Indian university, and that it had recommended that such a standard was sufficient for a student to commence the study of engineering. The average age of candidates who entered for the intermediate examination was, he added, 18.

3,897. He considered that a candidate of fair abilities ought to be able to acquire the requisite standard of general education at 18. He did not desire, however, that admission to the college should be made from among persons who had passed the intermediate arts examination, but that admission should be regulated by an entrance examination of about the same standard. Such a system he considered would attract the students who at present continued to read in Arts colleges after passing the intermediate examination. Since the intermediate arts examination did not constitute a definite or final stage of a university general education it was consequently wrong in principle to recommend such an examination as a standard for admission to a professional college unconnected with a university. It would accordingly be better to keep students at school till they had reached the standard for admission to the college. But he remarked that as a matter of fact the standard of education that was required of students before they appeared for the intermediate arts examination was about as high as would be needed for admission to Roorkee. He suggested that students might reach this standard better if they stayed on a year or two longer at their respective schools than if they entered a college, where the teaching was necessarily of a more literary form than that generally imparted at schools, and considered it quite possible, since students were allowed in the high schools of the United Provinces, after passing the school leaving certificate examination, to stay on and take further courses in such subjects as higher mathematics,

to give in these high schools a course of advanced instruction corresponding in standard to the intermediate arts. Students occasionally stayed on in the government high schools of the province and took further courses for the school leaving certificate examination, and he felt sure that these schools would be able to give students the necessary education if they were encouraged to prepare candidates for the Roorkee College examination. In short, he desired to point out that the intermediate arts student in the course of studying at a college reached a certain standard of general education, and that this standard might be reached much more quickly and more satisfactorily by continuing studies at school. His attention was here drawn to the fact that the Roorkee College had been designed, not merely for the United Provinces, but also for certain other provinces including the Punjab, the Central Provinces and Bihar and Orissa, and he remarked that although he did not think any of these provinces had started advanced school courses similar to those existent in the United Provinces high schools, those provinces would perhaps find it worth their while to make arrangements to teach their students up to the standard he recommended, if the Roorkee College prescribed it. He added that students who entered the University and passed the intermediate arts examination might also be allowed to appear for the entrance examination which he had suggested if the college were affiliated to the University.

3,898. One of the chief advantages that would accrue to the Roorkee College from affiliation to the local University was that the staff would be brought into closer contact with other educationists and that there would be more co-ordination than existed at present; Roorkee was at present rather cut off from the educational life of the province. The establishment of an engineering Faculty in the University would result in the appointment to the University of Fellows who were competent to dispose of engineering questions and courses as had been done in the case of the Medical College. This latter college had been affiliated to the Allahabad University and there was at present a Medical Faculty which was composed partly of medical men and partly of scientists in other branches. Work was conducted harmoniously and the medical professors derived considerable advantage by meeting these scientists. The medical members of the Faculty would probably be very sorry indeed if they had not this opportunity of meeting their science colleagues in the University, and discussing with them some of their educational problems. A further advantage that would accrue from affiliation would be the granting of an engineering degree. There was a feeling in India that the possession of a degree was of marketable value, and hence some of the better students who at present proceeded to Arts colleges to take up the B.A., B.Sc. or M.Sc. courses might be induced to go instead to Roorkee, if they were able to secure a degree in engineering. The non-possession of a degree at present rendered it often difficult for a man in India to secure employment. Since it was quite possible for members of the Roorkee staff to attend meetings of the Board of Studies, the Faculty or Senate, (and perhaps also the meetings of the Syndicate) the advantage he anticipated that Roorkee would derive by being brought into closer contact with other educational influences in the province would not be lessened by the fact that Roorkee was rather isolated by its situation. Nor would such advantage be much less than in the case of the Medical College, since officers from that college had periodically to come down to Allahabad from Lucknow to attend meetings. As the staff at Roorkee might be drawn upon and to a certain extent persons of eminence in science might be appointed, he did not agree with the contention that, as engineering was practically undeveloped in the United Provinces, in that very few engineers were connected with education and very few large private engineering firms who employed engineers of repute existed, it would be extremely difficult to constitute a suitable Faculty of Engineering. In his opinion it was not necessary for every member of such a Faculty to be a civil engineer, nor that each member should have some relation with engineering generally. He cited in

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support of his contention the Medical Faculty and remarked that great advantage had been derived from having scientific members in that Faculty. He did not agree that pure science was of much greater use to medicine than it was to engineering.

3,899. Though endeavour was generally made to avoid appointing the professor of a particular subject an examiner in that subject, it had frequently been found advisable to depart from this course and to appoint the actual teacher of a subject the examiner. Hence in order to obviate any difficulty that might arise in constituting a satisfactory Board of Examiners for Roorkee, he suggested that the professors in that college might not be debarred from appointment as examiners in their respective subjects. They could also draw on other engineering colleges for examiners. It might then be possible to have an internal and an external examiner in each subject.

3,900. The establishment of a Faculty of Engineering in the local University might constitute an attraction to students owing to the fact that the possession of a degree was in most cases looked upon as a passport for appointment to certain government services. He admitted, however, that the B.E. degree could not be treated on a par in this respect with the B.A. or B.Sc., but remarked that the fact that a man possessed a degree tended to increase his commercial value. At present a student who was not among the first six or eight who passed out from Roorkee in a particular year had frequently to accept work which was very often other than that of an engineer, and he knew of a case where a student had found it necessary to enter an Arts college, after passing out from Roorkee, to obtain an Arts degree in order to secure employment. He was certain that the average student would regard the attachment of a degree to the Roorkee College course as an attraction, and though he hoped that in India, as in England, the possession of a degree might not in itself be taken as a passport for entry into government service, the prevailing impression undoubtedly was that a student's prospects of employment were greatly enhanced by the possession of a degree.

3,901. The proposed Faculty of Engineering should be a small one and consist mainly of members of the staff of the civil engineering college of the province. He had advisedly suggested this in order to meet the objections that had been put forward against affiliation in other provinces, namely that, as the engineering Faculties of the local Universities contained a fairly large element of pure scientists, the result had been that the course of studies framed had included much more pure science than was really essential for an engineer. In other words, that the course of studies had been overweighted with pure science at the expense of engineering subjects, e.g., the standards laid down for mathematics, physics and chemistry were considerably higher than was required for the training of an engineer. Since there were a large number of eminent engineers in the Public Works Department, whose number was not very much less than that of the distinguished medical men, he did not admit the contention that the constitution of a Faculty, which had been possible in the case of the Medical College, was not possible in the case of the Engineering College, nor did he agree that the medical profession had reached a much more advanced stage than the engineering profession. He considered, however, that certain safeguards should be adopted in constituting an engineering Faculty. By this he meant that the majority of the members of the Faculty should be civil engineers, the remainder being composed of scientists, and that the Faculty should necessarily be a small one.

3,902. The possession of a degree by a student who had passed through an engineering college ought not to be taken to imply that such an individual was competent to undertake the work of a civil engineer, since such a student had merely been through a theoretical course of engineering and had been given, in that course, an exposition of certain general principles. He expressed this opinion in connection with the criticism that in exercising their control certain Universities had insisted on the conferment of the B.E. degree purely as a result

of an examination in theory and had declined to permit practical work to be taken into account, and that this practice had resulted in the discouragement of practical training which was desirable in an engineering course. The competency of an engineer ought, in his opinion, to be tested later, in, say a designing office, but the fact that a particular student possessed a degree might be of general help to him in after life. He deprecated the possession of a degree being regarded as a certificate that the possessor was a competent engineer as he considered that it should be taken to imply merely that a man had been through an educational course that was considered necessary to turn out an engineer. He was personally inclined to favour the conferment of a degree after the theoretical course and to leave it to the employer of a degree holder subsequently to find out whether the possessor was a fit engineer or not. The Public Works Department might employ young graduate engineers on probation for two or three years, during which period these individuals might be posted to an office where designing was in progress, or where plans and estimates were being prepared, or some project was being framed, and if they did not work satisfactorily their services might be dispensed with.

3,903. (Mr. Cobb.) He explained that by his remarks in connection with the conferment of an engineering degree by the university, he did not mean to imply that a degree had necessarily a market value attached to it, since he was not at all sure of this, but that he surmised that better students might be induced to enter Roorkee if they were certain that at the end of their studies there they would, if successful, receive a university degree. It did, however, seem apparent that an Arts degree had something of the nature of a market value attached to it. Both English and Indian firms favoured the employment of engineers who, other things being equal, possessed a degree, and from the student's point of view he considered that a student would welcome the opportunity of being able to write after his name, if not the letters B.A., or B.Sc., at least those of B.E.

3,904. High schools in the United Provinces were encouraged to keep boys up to the age of 16, at which age students generally appeared for the matriculation examination or the school leaving certificate, but occasionally a boy stayed on in school in order to qualify himself in other subjects up to the age of 18, and this practice of keeping students on at school was growing. The teachers in such institutions kept in touch with the Roorkee College courses and good head-masters took considerable interest in the future careers of their scholars. The Educational Department encouraged contact with the several professional institutions in the province, by sending out notices to schools of careers that were open to candidates for such services as the Forest, etc.

3,905. The whole of the sum of Rs. 62,430 estimated as the cost of the main building for the government high school at Gorakhpur had been paid by the Department of Education under government orders to the private firm that had been engaged for the supervision of the construction of certain schools, and no portion of it had been held back till the completion of the building. In view of the possibility that it might cost less, the firm had undertaken to get the building erected for this sum and to supervise construction, and if it were found that the expenditure involved was less than was anticipated the firm would restore the balance to the department. He believed that the firm were contemplating in one case to return to the Education Department a sum of about Rs. 2,000 or Rs. 3,000. It had not been the practice of the Department of Education to pay the whole amount to the firm in advance, but rather to make payments as bills were received from the firm. The firm was, however, expected to show in the final bills how much had actually been spent on each work.

3,906. (Rai Bahadur Ganga Ram.) In his opinion it was rather the good fortune than the misfortune of the Roorkee College to be situated within the geographical limits of the United Provinces, and in spite of the fact that, on an average for the last 20 years, the number of students

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from the Punjab who had passed out from this institution had been greater than the number from the United Provinces, he considered that the college ought to be affiliated to the Allahabad University rather than to the Punjab University, more especially in view of the fact that the number of Punjabi students who had passed out in recent years had been steadily declining.

3,007. He admitted that by reducing the admission age to 18 years, B.As., would be debarred. This would not unfavourably effect Punjab students for, as the age for admission to the intermediate arts examination in the Punjab had been fixed at 17, Punjab students would after passing that examination have about a year in which to prepare for the entrance examination to Roorkee. The present rules regarding admission to Roorkee, instead of placing obstacles in the way of students from the Punjab, actually favoured them, and this was one of the reasons why such students had in the past gained admission to Roorkee in such large numbers. As the age for the intermediate arts had been fixed in the Punjab at 17 and that for the B.A. at 19, students from that province took their arts degree earlier than men from the United Provinces did. The latter generally had only about two months to prepare for the Roorkee entrance examination, whereas the former had as much as nine or ten months. Hence the present system had afforded better opportunities to men from the Punjab. Since the practice of instituting classes for further study after the school leaving certificate had not adversely affected the number of men from the United Provinces who had yearly entered Roorkee, he did not think their introduction in the Punjab would debar students of that province from entering Roorkee. Students of the United Provinces with an intermediate arts standard of general education were in his opinion quite able to follow lectures in English. The standard of mathematics at present required of students who appeared for the entrance examination to Roorkee, though not up to the intermediate arts standard, was a good deal higher than that of the high school and his suggestion was that a higher equivalent to that of the intermediate arts might with advantage be taught in schools.

3,008. In respect to his previous reference to a school which the Bishop of Lucknow was having erected at Meerut, he remarked that he was not able to state whether the Bishop had offered to pay the Public Works Department a percentage for the preparation of estimates and supervision. He thought the Public Works Department were overworked and could not spare the time to comply with the Bishop's request. There was no official correspondence with him to show that the Bishop had sent in a formal application to the Public Works Department, but the Bishop had discussed the matter with certain officers of that Department.

3,009. The correspondence that had passed between the Education Department and the private firm of consulting engineers which had undertaken the construction of several educational buildings in the province contained the offer of the firm to undertake repairs to the buildings they erected at a charge of 1½ per cent. on the capital cost of each of the several works. This offer referred chiefly to the government high schools each of which was usually worth between Rs. 60,000 and Rs. 70,000.

3,010. (Sir Noel Kershaw.) The Public Works Department needed men who would be immediately available for a certain specified kind of work, i.e., as Assistant Engineers to assist engineers largely in routine duties, but it was desirable from an educational point of view that engineering students should be trained for something higher than that which the Public Works Department immediately needed them for. The theoretical instruction given at the Roorkee Engineering College was

high enough for the work that Assistant Engineers of the Public Works Department were called upon to perform, but educational officers contended that in order to develop men into really good engineers they should be given a better mental equipment. Public Works Department engineers looked to the immediate needs of their Department, whereas educational officers desired to develop in India a school of engineering which should be as high as any in Europe. He did not think the former where the best judges of the course of instruction that should be given at Roorkee. He added that if, instead of looking to the future career of a man, attention were paid only to his immediate fitness for employment, it was possible that some of the higher training which would be useful to such an individual in forging ahead in his profession might be sacrificed to a desire to acquaint him with mere routine work.

3,011. (Mr. Willmott.) As an example of a building which he had in mind when he recorded the following statement in his written evidence—"There are, however, within my knowledge examples of buildings erected more cheaply, which have stood the test of time and wear quite as satisfactorily as any building either erected by the Public Works Department or supervised by the Public Works Department in the course of erection" he cited the second hostel that had been built for the Aligarh Mohammedan Anglo-Oriental College entirely through private agency. It was true that this structure had been erected about 15 or 18 years previously, but the building was very well built and the Chief Engineer at the time when it was erected had complimented the building committee of the college on having had erected so good and cheap a structure. By this example he meant to draw attention to the fact that it was quite possible for cheap and satisfactory buildings to be erected by private agency. He did not mean to cast any reflection on the work of the Public Works Department by his statement. On the other hand, he had known of serious failures in connection with large schools that had been erected by private bodies without the aid of the Public Works Department. As an instance he quoted the case of the Haggard Memorial building at Lucknow which fell during the recent floods, 12 or 13 years after its construction. A large double-storied university hostel close to the Muir Central College had been built entirely by private agency during his term of office and he had heard no complaints regarding the work.

3,012. In connection with the inspection during construction of government-aided institutions he was informed that certain detailed rules of the Public Works Department laid down a great deal more than mere inspections. He replied that this was a matter for the Public Works Department, but that, as far as the Department of Education was concerned, the Educational Code laid down that the Public Works Department should inspect a building at certain stages of construction. The final certificate forwarded to the Director of Public Instruction did not give that officer any detailed information as to the manner in which a work had been carried out.

3,013. The Chief Engineer had noted his views on the plans and estimates of each building that had been handed over for construction to the firm of consulting engineers he had previously referred to. The period during which this firm had expressed themselves as willing to undertake the repairs to the buildings they had constructed at a charge of 1½ per cent. was three years. He did not know the present average annual cost to government of repairs to educational buildings, and had not considered the private firm's offer as yet. He would in this connection probably eventually seek the Chief Engineer's advice, but he had not even entered into correspondence with the firm on the point.

The Hon'ble Mr. J. S. CAMPBELL, C.S.I., C.I.E., I.C.S., Member of the Board of Revenue, United Provinces.

Written Statement.

3,014. (I). Economy and suitability of methods of execution of public works and (II). Encouragement

of other agency.—Although I am the Member of the Board of Revenue in charge of the department of revenue buildings and also president of the Sanitary Board, I

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cannot say that I have had such experience of recent years as to justify me in criticising the work and methods of the Public Works Department at first hand. District officers come much more in touch with the actual work and know "where the shoe pinches."

(2) Certainly according to the "man in the street" work done through the agency of the Public Works Department is both expensive and inferior. I should myself have said that it was as a general rule expensive but good. But there can be no two opinions, I think, that the methods of the Public Works Department are as a rule slow and un-imaginative. I agree with most of the officers who have been consulted that this is probably due to the deterioration in the quality of the lower superior staff, with the result that Superintending and Executive Engineers have to scrutinize details and exercise personal supervision over construction to a greater extent than should be necessary if district surveyors and men of that type had higher professional qualifications and better financial prospects. It should be borne in mind that the Public Works Department are at present occupied with plans and estimates and supervision: and that all construction is already in the hands of contractors (so-called). But outside the big cities, where there are now some few firms of repute and standing, the ordinary contractor is of an inferior type, with little capital and less engineering skill; and he merely tenders for a work at rates suggested to him in the estimates and not according to his own knowledge of the value of materials and labour.

(3) The Public Works Department would probably

themselves welcome a better class of contractor, but hitherto the demand has not yet created the supply: and I can make no suggestions towards improving the latter.

(4) I agree with most of the officers consulted that one well paid district engineer could in most districts supervise both Public Works Department and district board works and would give more satisfaction than an underpaid district surveyor and a badly trained district board supervisor: for there can be no doubt that district boards at present have to take the leavings of the Public Works Department.

(5) I know of no existing agency to which the construction and upkeep of works now under the control of the Public Works Department could be entrusted without a serious risk of deterioration.

3,015. (III.) Changes in organization.—I certainly think the time has come when there should be more specialists in the Public Works Department or when specialists outside the Department should be more freely consulted in the preparation of special projects of a technical nature. It is impossible for one man to have the latest information and expert knowledge about such varied subjects as sewers, tube-wells, electric lighting, reinforced concrete, hydraulic lifts and other multifarious subjects: and there must inevitably be mistakes and undesirable delay while he acquires the necessary information.

(2) The crying want of the Department is in my opinion an improved personnel with better pay. And such a staff would soon recoup its pay in improved work at a reduced cost.

The Hon'ble Mr. J. S. CAMPBELL called and examined.

3,016. (President.) The witness stated that he was a Member of the Board of Revenue, but that he did not deal with questions concerning local self-government in his capacity as such. The Board possessed their own revenue buildings and had no connection with the Public Works Department except in regard to these buildings. He had had a good deal of experience of the working of district boards as he had been *ex-officio* chairman of district boards when he was a Magistrate and Collector.

3,017. He had no knowledge of the system which was in force in the early eighties under which all government roads and buildings in the districts were managed by the district boards, as he came out to India as an Assistant Magistrate in 1883.

3,018. *Prima facie*, one agency for the supervision of all the roads and buildings in a district was better than the present system of having two such agencies. He doubted, however, whether the transfer to the boards of all government roads and buildings would be feasible at the present juncture, as district members did not evince a sufficient interest in their work. The district board members were ordinarily *zamindars*, and it would be difficult for them to go four or five miles away from their homes in order to inspect public works. His more recent experience had been in the hills where he had found that an engineer had to traverse 60 to 70 miles of a road for which he was not responsible to inspect a bridge. It was obvious that this engineer could very well be placed in charge of the road also. He was therefore in favour of one agency, but was indifferent as to what agency was employed as long as it was well paid. The present district board engineers were men who had been rejected by the Public Works Department and who received a low rate of pay and this was detrimental to efficiency. He was not opposed to the extension of local self-government, but was of opinion that this would develop with the flux of time. It would be difficult to secure proper supervision once the official chairman was dispensed with and the transfer of government roads and buildings should be made gradually to such district boards as possessed a competent engineering staff, subject to the supervision of work by a government Inspector of Works who should be the professional adviser to the Commissioner of the division. A start in this direction could suitably be made in the United Provinces except at headquarters stations like Lucknow, Allahabad, etc.,

but it would be necessary for government to retain some powers of financial control to satisfy themselves that the funds made over to district boards were properly spent. He anticipated there would be no difficulty from a government point of view in effecting the transfer he advocated even if official chairmen were replaced by non-officials, as government would presumably reserve the right to withdraw the grant in cases of extravagant expenditure.

3,019. He did not think that it would be feasible from the local self-government point of view to introduce a combined cadre for the whole province in order to admit of the promotion of district engineers from one district to another, as the boards would regard such transfers as an interference with their powers. Besides a district board which had a good district engineer would not like to part with his services.

3,020. He did not approve of the suggestion that each department should be made responsible for the maintenance of its own buildings as was the case in the Police Department, as he considered the departments would not have the expert knowledge to supervise such repairs. *Tehsildars* in the United Provinces had at one time been responsible for the repair of *tehsil* buildings, but the system had not proved satisfactory, and if it was re-introduced it would result in larger expenditure and inefficient work.

3,021. He admitted that it was the case that several departments, including the Revenue Department, requisitioned the Public Works Department for the preparation of a large number of plans and estimates for projects which never materialized and for which no funds were, or were likely to be, available in the near future, and that this had resulted in the accumulation in Public Works Department offices of a great amount of work. He explained, however, that it was very difficult to avoid this as it was necessary to have projects prepared before asking for funds and it was also difficult to foresee when money would be available. He added that the Revenue Department did not call for any unnecessary details as sanction for the preparation of a project was accorded by the board and the department had to justify the necessity for a project before plans and estimates could be called for.

3,022. Administrative departments constantly changed their ideas after they received detailed plans and esti-

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mates. This necessitated the revision of plans four or five times, and was largely due to a change of Magistrates in the districts concerned. There were no standard plans for district offices, but there were such plans for *tehsils* and other smaller buildings, and the main difficulty in the above connection was in the case of sanitary projects, as municipalities frequently asked for the preparation of plans for drainage schemes costing very much more than they could afford to spend and would follow this up by asking for plans for a water-works scheme, neither of the schemes being subsequently carried out. Stops had, however, been taken to ensure that municipalities were prepared to meet the expenditure on schemes for which they had asked for the preparation of plans.

3,923. He had no concern with the Public Works Department budget, and only submitted his own budget of expenditure on revenue buildings to the Finance Department. He added that revenue buildings were inferior mainly because sufficient money was not allotted for them. He had received a grant of Rs. 2½ lakhs in the current year, but this grant was exceptionally large as compared with grants he had received since the outbreak of war.

3,924. It was not the practice for government to levy a percentage charge for establishment on contribution works carried out by the Public Works Department such as hospitals, provided the works were of a charitable nature. He did not think there was anything wrong in this principle as people very often offered a considerable sum for the construction of a hospital on the understanding that the building was to be constructed by the Public Works Department. He admitted, however, that this practice affected the establishment charges of the Department considerably. The charge in the case of ordinary works amounted to nearly 16 per cent.

3,925. With reference to the two opposite views put before the Committee, firstly that the services of the Superintending Engineer could easily be dispensed with if the status of the Executive Engineer were improved and a better class of officer selected as Executive Engineer, and secondly that the Superintending Engineer was a useful officer, he was inclined to agree with the former and was of the opinion that the Superintending Engineer's grade was merely a promotion grade for Executive Engineers. He had never derived any real assistance from a Superintending Engineer and was therefore in favour of the abolition of his post provided the status of Executive Engineers was improved, that they did not lose anything by the change and had the same prospects of promotion as at present.

3,926. He had had a great deal of experience of famine administration as a Commissioner and was of opinion that there would be no difficulty in the execution of famine works under the scheme for entrusting government roads and buildings to district boards with competent engineering staff subject to the supervision of a small Public Works Department inspecting staff. The famine staff was generally temporary. Famine works could be selected in advance and projects prepared beforehand so that on the declaration of a famine relief work would be started at once by a *nail tehsildar* with the assistance of a sub-overseer, the former being responsible for all payments and the arrangements in connection with labour, etc. The Public Works Department staff at present formed an important nucleus for famine work, but this staff also had to be largely augmented by temporary staff in the case of famine. Hence if the Public Works Department staff were transferred to district boards there would be no prejudicial effect on famine administration so long as government had the power to requisition district engineers for famine work. Theoretically the district boards were already responsible for famine work. The district board staff would, he thought, be as efficient to check famine as the existing Public Works Department staff.

3,927. The staff of the Public Works Department had, generally speaking, deteriorated and the lower paid district surveyors were not of the same class as the men

formerly obtainable. Hence the organization of the Public Works Department would be greatly improved by having a smaller number of better paid subordinates. A large number of the present subordinates, in his opinion, held positions which they were not competent or intended to fill. For instance when he came to India a large proportion of the districts was staffed by district engineers from Coopers Hill. These men possessed higher qualifications and the young engineer had thus opportunity to learn his work as district engineer more thoroughly. He was besides required to put in a long period before he was promoted to be Executive Engineer. Apart from this, there was then one Executive Engineer for 6 districts instead of one for 3 as at present, the number of superior appointments having increased from 10 to 16. On the other hand an Assistant Engineer now-a-days became an Executive Engineer after 5 years' service and worked for a very short time as district engineer. The natural result was that the district posts were mostly held by supervisors and sub-divisional officers.

3,928. (Sir Noel Kerahaw.) There was no selection for appointment to the post of Executive Engineer and officers were appointed to executive rank by virtue of seniority alone. He knew of no instance of an officer having been superseded. Promotion by seniority to executive rank was suitable as the pay of an Assistant Engineer was insufficient and that officer was really under training while he held the rank of Assistant Engineer. His first responsible post was that of Executive Engineer, and if he were tried and found wanting in this appointment he could not rise higher. The witness was not sufficiently familiar with the departmental rules to pronounce an opinion as to whether the qualifications of engineers could not be tested while they were Assistant Engineers.

3,929. If a municipality had a very good man whom they desired to retain and whom another district board wished to employ, there would probably be no limit to the salary which the municipality would be prepared to pay him in order to retain his services, such payment being of course regulated according to the means of the municipality concerned. On the other hand, if there was a combined graded cadre for all district engineers in the province, an engineer might be transferred from Allahabad to Lucknow, for instance, without the Allahabad board having been consulted. The cadre system would no doubt be a good one from the point of view of district engineers, but it could not be introduced without interfering unduly with the powers of district boards.

3,930. Many of the district boards did not pay their engineers as highly as the Public Works Department, but they did not at the same time expect the same class of work. If all government works, however, were transferred to district boards, the boards would be able to pay their engineers the same rate of pay as the Public Works Department. The reason why many engineers did not care for employment in district boards was that they were required to serve too many masters.

3,931. (Rai Bahadur Gangai Ram.) His remarks regarding the deterioration in the Public Works Department staff applied only to subordinates. One of the reasons for this deterioration might be the fact that the cost of living had greatly increased while the pay of subordinates had remained what it was 50 years ago. In his opinion subordinates did not possess sufficient professional qualifications to be placed in charge of districts.

3,932. (Mr. Cobb.) His main complaint against subordinates was that they were placed in positions which were not intended for them. If these men were put in their proper places they would be all right as there was nothing really wrong with them. The root of the evil was that they were called upon to undertake duties which were too heavy for them.

3,933. The members composing the district boards were mostly *zamindars* and this was the class of people which government endeavoured to get on the boards. There were a certain number of lawyers also, but there were more *zamindars* than lawyers.

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[Continued.]

At Allahabad, Monday, 2nd April 1917.

PRESENT :

F. G. SLY, Esq., C.S.J., I.C.S. (President.)

SIR NOEL KERSHAW, K.C.B.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

The Hon'ble Mr. H. M. WILLMOTT, F.C.S., A.M.I.C.E., Chief Engineer and Secretary to the Government of the United Provinces, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary.)

F. LISHMAN, Esq., F.R.I.B.A., Consulting Architect to the Government of the United Provinces.

Written Statement.

3,934. (Inter-departmental relations.) First taking paragraph 2 (IV) of the Government of India's Resolution No. 66 E.A. of 24th November 1916, as the point with which this office is the more nearly concerned, I am inclined to think myself that while the Department does meet the reasonable needs of the "other departments" it might meet them a great deal better. The other departments might assist largely in bringing this about,

(1) by forming a clearer idea of their requirements before they call or bring in the Department's executive officers ;

(2) by a closer and readier co-operation with those officers while projects are under development ; and

(3) by taking greater advantage of the services of Government's Consulting Architect which they should consider as freely at their disposal at all times.

3,935. Much time and energy is wasted on this score for which the Department is unjustly visited with the blame. It is up to the "other department" to know what it wants before it calls in say a hapless Executive Engineer to 'get out a plan'. I have in my mind a case where a civil officer on being asked about the requirements which the Board of Revenue had itself directed to be "worked out in detail" replied "Oh that means it is for the Public Works Department to do". That was probably an extreme case. The Department before it can supply a need must know what that need is. Even my limited experience here has shown me how much unnecessary work has been done and wasted owing to conflicting counsels, changed intentions, and lack of fixed purpose in administration or departmental requirements or policy. A recent case occurs to me where complete working drawings were got out to specific requirements (in this case for the Excise Department) when almost immediately afterwards the whole plan had to be remodelled to new conditions, and yet a third design to still different requirements was asked for but not pressed for on representation being made as to there being a limit. So design No. 2 now stands. This was luckily only a very small building : but, even so, it does not tend to show good returns on an office staff and expenses from a business point of view. And all such miscarriages rebound on the Department, tending to give it an unmerited reputation for dilatoriness, inefficiency, waste.

(2). Any public body at home, before embarking upon a building project, would define, in schedule form, its general and specific requirements for the information of the Architect. Upon this schedule he would work to some purpose on preliminary designs and proceed to get into close consultation with those concerned. Heads of departments out here should do the same. Not that the Consulting Architect would not help them on many points in the preparation of the schedule itself but it is clearly for them to state their requirements in detail.

3,936. On this follows (2). One's own personal experience in this respect has been, almost without exception,

felicitous ; but in projects which have come before one, one cannot but feel that had the several officers concerned got and kept in closer touch with each other in the production of the schemes, the results would have been better. The Public Works officer perhaps has a natural hesitancy in worrying other civil officers about details and at times it may be difficult for—shall I say—a Collector, in the midst of his manifold other duties, to look upon the Architect (or department engineer, where the Architect is not called in) pressing for necessary particulars as other than a bore and a nuisance especially when he feels or knows that it is ten to one he will be transferred or retired before the scheme will be realised, and one has in several instances been struck by the keenness displayed under the conditions prevailing. Still greater co-operation would tend to greater efficiency.

3,937. It should be made clearer and more definitely known to the various heads of other departments that the Consulting Architect's services are available to all who would consult him so that any opening for the lament "we didn't know we could get hold of you" or "we thought this was scarcely your job" or "we understood you were too busy" be guarded against. There must be many instances from time to time (I can think of at least one in the past) where possibly let us say, a Commissioner or Chief of Police or whom you will, would like to get in touch with the Consulting Architect on a project before it is even in embryo in order to see whether anything may be possible before he goes further. Such a call might be either (a) personal or unofficial, or (b) through the departmental Secretariat. To keep matters regular the Consulting Architect would, I suppose, have to keep the Chief Engineer, Buildings and Roads Branch, informed of such proceedings but he should feel free to respond to a civil officer's request without the loss of time entailed in seeking the official sanction of the Chief Engineer. The ready answer in the way of an objection to this is that it is impossible on account of the vast increase of work it would mean to the Consulting Architect, were civil officers to avail themselves extensively of such access. But that objection does not really hold. The number of architects who refuse work at home because they are too busy are few indeed. Neither does their work deteriorate in quality by having more of it. Rather the other way, greater experience bringing greater facility. What does he do ? He increases his staff and is moreover able to command the services of a more able set of men to have round him. To apply this out here, the Consulting Architect's staff would be increased as occasion might demand. This would not, however, necessarily mean at greater cost to government. It would mean, if properly carried through, recruiting to the local Government a young trained Architect (say commencing on Rs. 600 to Rs. 800 per month) every now and again—one every few years as building activities might demand,—instead of a young engineer. Or in other words (how or

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it might be done) reducing the engineering staff and increasing the architectural in proportion. One ought, perhaps, to note carefully that this proposal would not affect the prospects of the permanent staff of the Department but only future recruiting as time went on. It is of course too unthinkable drastic for present consideration, but, without a doubt, what ought to be aimed at is an exclusively building department run by architects as architects run their own works at home. (There would still be plenty of work on the engineering side). You have at home the architect to the London County Council. There is His Majesty's Office of Works and so on.

(2). Even as at present, with the Consulting Architect working alone and unsupported by any Assistant Architect (in these provinces), his services could be made more use of as suggested without adding much to his work while it would certainly reduce that of the Superintending, Executive and district engineers' offices so enabling these staffs to do their engineering or routine work more efficiently or perhaps to take charge of larger districts, releasing men for other duties, easing the 'carrying on' over the present period of dearth in recruiting from England. For it is nothing short of grievous to have scheme after scheme sent up to one (in some cases fully worked out even to detailed estimates) for advice when it is obvious almost at a glance that the only thing to do is to begin absolutely anew, when had the Consulting Architect been called in earlier he might at least, and in less time, have put the project on the right lines at the commencement if not have taken it right through. Such drawings often enough come to hand with a very border of signatures of officers concerned. The onus is then on the Consulting Architect who causes delay in recasting the project which everybody (except he who has fortunately bethought him of the existence of that officer) has approved, it taking indeed a liberal minded signatory to recognise the need of any change at all to that to which he has put his hand. This point is emphasized as it is not conceived to be in the best interests of government that the Consulting Architect should find owing to important points having already been settled that he is tied by conditions which might have been avoided had he been consulted earlier. A reference is invited to the Public Works Department Code, Volume I, General Regulations, page 270, paragraph 811. A suitable amendment or addition here to meet the case would doubtless readily suggest itself to government. I do not know whether the "Manual of Orders" is in the hands of civil officers: if it be: their attention might be directed to Appendix XXXVII, paragraph 3 (transcribed below paragraph 3961 of these notes.) I emphasize these references because it is conceivable that a civil officer might desire to consult the Consulting Architect and might find the Superintending Engineer discourage such a course. With the above provision the civil officer would know the course open to him. Superintending Engineer's relations with the Consulting Architect are dealt with later on.

3,938. (*Irrigation Department building works.*) Although the Irrigation Department is, I suppose, closely allied to the Department under review it has not in these provinces, up to the present, availed itself of the Consulting Architect's services except in the one case of designs for an irrigation museum. In other parts of India the Consulting Architect has been called in in connection with irrigation building works—dams and so forth, and I suggest that the services of the Consulting Architect might be made still more useful to government if similar action were taken in these provinces as occasion might arise.

3,939. (*System of budgetting and allotment of funds.*) With the Financial Department it is not so much a question of the Public Works Department meeting its needs as of the needs of the latter being met by the former. The system in vogue, that of annual budgetting and allotment of funds, may be necessary but it hampers building operation and encourages, almost necessitates, rash or forced expenditure if not actual waste so that the money be spent and a lapse of allotment be avoided in the

financial year. On the other hand it may interfere with a contractor's progress on the work who, building quicker than was expected, finds himself pulled up for lack of funds until the new financial year sets in. There should be a sinking fund or a reserve or emergency bank of some sort where savings would not be lost to the original account but could be carried over, and from which further properly authorised drafts could be drawn when the occasion necessitated it.

3,940. (*Private engineers and contractors.*) In the matter of lack of co-operation with other departments leading to waste in the energies and fruitless expenditure on the part of the Public Works Department a case might be cited where complete designs and estimates were produced and the whole of the work handed over to be started *de novo* by a firm of private engineers and contractors. In such a case, in any case where designs are prepared by private agency, government should avail itself of the services of their Consulting Architect at least to the extent of calling for a report from him on the designs so obtained. The Consulting Architect might conceivably find himself placed in a somewhat invidious position in having so to report and such a report might not have to be too critical, but he should at least have an opportunity to warn government against serious defects in planning and construction and the graver offences against the architectural proprieties.

3,941. (*Assistant Architect or outside agency.*) If the Consulting Architect cannot single-handed meet all the demands made, or which might be made, upon his time, one or more Assistant Architects should be got from England as occasion might demand and as has already been done in certain other provinces. It is perhaps conceivable however that there might be a transition stage or period wherein government might not feel justified (on the estimate of prospective running calls upon their Consulting Architect) in recruiting another man from home. During such a period private agency, in the shape of an architect practising in India, might possibly be employed to design and superintend certain buildings. But their own architect would have to be very hard run before this would be necessary and even then it should only be done with some of the simpler or minor works and in any case the fees properly chargeable would be more than the cost of production in the Government Architect's office (please see paragraphs 3968 and 3939). Such private practitioner would superintend and 'run' the work being built from his design; but he would not be the contractor.

3,942. (*Dual service as "architect and contractor" should not be admitted.*) The dual office or service of architect and contractor is anomalous and does not work, though from what I can gather the Education Department has indulged in disposing work to a firm working in this dual capacity but with what results I do not know. For however honest and conscientious a contractor may be there must be times in the progress of every work where his interest and those of the building owner, i.e., here, government—as represented by the Architect, must clash.

3,943. (*Conduct of works.*) It cannot be said that the relations between the various sub-divisions of the Buildings and Roads Branch are satisfactory as judged from the broad architectural—building—point of view. Much hinges round the question of defining the extent of the duties and the degree of responsibility to be attached to the fulfilment thereof respectively of the civil engineering and the architectural sides of the Department's activities. With this must be coupled the whole question of designing, estimating, contract, contractors, execution of works, superintendence, final accounts, office staff, etc. It may be stated at once that one proposes to deal with the question strictly from the professional—the architectural—the building point of view, as I take it for granted that government, in asking for the Consulting Architect to place his view before the Committee, desires that such views should be stated clearly and frankly and without prejudice.

3,944. (*Co-operation of the architect with the engineer.*) The Architect has come to India as a stranger in the land.

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There is next to nothing in the nature of an architectural 'service'. He is 'temporary' and 'non-pensionable.' He comes, and perchance finds himself called in to design buildings which, but for his advent, would in the ordinary course of events have been given to some one or other engineer, a permanent and pensionable officer, who whether he exercises it or not, has, one cannot help reflecting, by usage an almost prescriptive right to the handling of anything nice that is going in the way of building. Recognising this, one has been much struck by the loyalty with which the Architect has been received if not welcomed in these provinces. It is therefore with no anti-service or personal prejudices that one approaches a consideration of this reference. In inviting a full consideration of one's views I would suggest that although the comparatively short time one has been out here may tend to discount their value somewhat there may be found the compensating advantage of a fresh and unbiased vision on things as one has found them and seen them work out.

3,945. (*Designs.*) These should be developed, with the assistance of an adequate staff, from a schedule of requirements furnished by, and after consultation with those concerned. Such designs should be submitted in all the stages of development by the Architect personally for the consideration of government or the Department's officers. The Architect is the person alone able properly to explain his designs and fully discuss modifications or alternatives. His designs should not, especially in their early stages, be presented by the Chief Engineer or Superintending Engineer though they may well be presented with such officer. I have had experience of both and can conceive positions on one side and on the other where the presence or absence of the Architect might mean the difference between a job 'going through' or being 'crabbed'.

3,946. (*Respective spheres of influence.*) Where both Architect and engineer, whether Chief or of any other rank, recognise their proper sphere of operations and are not blind to their respective limitations there should be no friction whatsoever even though the Architect be, as is the case with the Consulting Architect to Government, 'subordinate to the Chief Engineer.' One recognises on one's own side that the Architect is somewhat of an innovation here and one cannot expect engineers in all cases quite fully to appreciate the etiquette of the profession all at once. Matters in that respect should adjust themselves in time. The Consulting Architect should not be subordinate to the Chief Engineer on professional points but only for administrative and technical purposes. I believe there is a strong consensus of opinion amongst Government Architects in India that the closer the conduct of building operations approximates to English ways and means the more satisfactory to government will be the results. The dividing line between the personal and the professional aspect of the case is very narrow. It can scarcely be said really to exist at all. Moreover they both concern government closely. For with an unsatisfactory professional position as inferior *personnel* it must inevitably result sooner or later to the disadvantage of government. At home the architect invariably runs his work through, even to the final passing of the accounts, in his client's interest. Here he has no executive control and can only get things done by tact and suasion it having to be a big matter before he goes to the length of appealing to a higher authority and making himself a nuisance. The home method of more independent control (always with safeguards) should be adopted here.

3,947. (*Contractors and estimates.*) The method of preparing estimates and obtaining contracts is crude in the extreme. There seems scarce a real builder in the provinces. The contractor is, as likely as not, a banker, or a retired judge who has no practical knowledge whatsoever of what he is about to take on. Apparently to accommodate this class of 'contractor' a fully-priced-out estimate is drawn up in the Department and on this the contractors compete for the work by offering to take it up in the lump at so much percentage under or over the prepared schedule of rates. The drawings are not

even looked at and would not be understood if they were. He no sooner gets to work than he begins to find he is not clearing his anticipated percentage and profit and before the work is finished has, by importunity, succeeded in getting back the margin of (and probably more) percentage by which he cut out his brother. Where a contractor is not capable of pricing out his own schedule of quantities his tender should not even be considered, and every contractor should be required to declare, in submitting his tender, that he had carefully examined the drawings and specifications and was prepared to be bound by them. With the other type of man government, with its Architect, is giving itself a hostage to fortune. I believe there are exceptions to this type of contractor and when he is found he should be encouraged. In no case should a contract be 'let' without the cognisance of the Consulting Architect.

3,948. (*Estimators.*) To break down the present custom of preparing estimates, I am persuaded it would be to the advantage of government to bring, for a short period of years, a quantity surveyor (with one assistant) out from home and attach him to the Consulting Architect's office where he would work in close co-operation with that officer and where, with the requisite staff of computers and so on and possibly with a senior Assistant Engineer on deputation, he would produce 'get out' estimates in detail for all works passing through the office and would see to the 'measuring up' of variations as works proceeded and to the final adjusting of the accounts. Yet I fear this may not commend itself as a very practicable proposal—but at least, an engineer with a distinct leaning towards building works and details of building estimating should be a regular member of the Consulting Architect's office.

3,949. (*All estimates should be prepared in the Architect's office.*) To produce the best 'estimate' and the best drawings to go with it the architect and the estimator require to be in the very closest collaboration such as cannot be attained where the estimate is prepared in a district or circle office. Consultations regarding local material, conditions, and so on would still be necessary with those officers, but the producing of the estimate would be with the quantity surveyor (or engineer) and the Consulting Architect in the latter's office. As noted above in another connection, this would effect a proportionate economy in the circle and district establishments.

3,950. (*An engineer required in the Architect's office.*) The engineer so deputed as above suggested would take over the steel-work, foundations, reinforced concrete construction, if any, with all calculations and stress diagrams and other specialized engineering branches of the works while the Architect would be more free to concentrate upon planning and designing and general building construction and details and to visit works in progress from his designs. I am strongly in favour of estimates being prepared in this office whether the 'quantity surveyor' be brought in or not. In the provinces at home quantities—estimates—are prepared in the architect's own office, I believe almost invariably. In London it is not the usual practice, but it amounts to very much the same thing as an architect in good practice is almost sure to have his regular quantity surveyor on the same staircase, across the square, or along the street, so he can keep in close touch with him while an estimate is being got out. Such close intercourse is quite impossible with the several circle offices in these provinces. It is in the architect's office that what is, or is not, on the drawings can be best interpreted. Estimates and drawings are brought on together and made to agree. There is much saving of time as the estimate can be started and got on with while some of the drawings are still in progress whereas the engineer at a distance very naturally looks for everything in the way of drawings and specification being absolutely fixed up and complete before he touches it. There are the additional advantages that it gives more time to develop points in planning or construction which otherwise have to be rushed and the labour and expense of preparing advance copies of the drawings, etc., is obviated as preliminary estimates can be prepared from the rough drawings in hand.

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Moreover, if Assistant Engineers went through the Consulting Architect's office regularly, say serving two years, they would go out with experience and knowledge and an understanding of architectural problems and architect's ways which would stand them and government in good stead in their future careers.

3,951. (*Full scope for contractors in the United Provinces.*) As regards private enterprise on the part of real building contractors there is nothing in government's attitude to prevent them, whether Indian or English, competing for, and if successful taking up contracts for works in these provinces. Personally I should more than welcome their advent and of course the greater their knowledge and experience as builders the less the need for a large and expensive staff of supervising government engineers. But, as noted above, the combined engineer (or architect) and contractor, however plausibly he be presented, government should have nothing to do with.

3,952. (*Need for real builders.*) At present, largely owing, I take it, to the fact that the contractor is not a builder, works are to all intents and purposes erected and built by the Department's own staff. It may perhaps be an overstatement for general application but I confess that I have found myself at a loss to know what the so-called 'contractor' does for his money where he has so many Public Works officers round him who, with the Architect, have practically to do his work for him. He is the last man to whom one goes to get a thing put right or to whom one would take the trouble to show how to do it. One perforce goes to the engineering staff where at home one would go to the builder's foreman or the builder himself.

3,953. (*Training in the building trades.*) The people wanted out here on works are "clerks of works" men with a real or practical knowledge of building who have gained that knowledge by working with good contractors and good architects at home. The architect should be in control of his own building with a clerk of works as his intermediary between him and the builder. A few really good clerks of works or builder's foreman got out from home for a few years would revolutionise the building trades here not only by their own work but by the training they could impart to the apprentices and others who come from Roorkee or elsewhere and, not least, to the *mistri* on the works. For that wonderful fellow—the Indian '*mistri*'—can do almost anything if he is only shown how and moreover he loves the doing of it. He and possibly an occasional subordinate, that invidious word, are the best people in the building way out here. Again, the actual bringing of "clerks of works" out to India may not be very practicable and so again we get back to the call for the young engineer with a real liking of, if not a genius for, building.

3,954. (*A 'building branch' required.*) At present it would appear to be a pure accident whether an engineer officer has had any practical building experience or not, whether he has any natural bent that way, whether he is inclined to learn, whether he will be keen on the job or look upon it as rather a bore and try to get a 'district' at the earliest opportunity. A proportion of young engineers should come out definitely to a Buildings Branch. They should know they are going to do so, and as a qualification should have had actual experience for two or three years on large building works at home under big contractors and good architects (or on the home government's own works).

3,955. (*Later recruitment to India.*) In order to enable them to acquire this experience they might be allowed to come out proportionately later than the usual run of engineer and this I consider would be all to the good. In this connection a personal incident may be related. Some three years ago when the selection of the junior engineering staff for certain building works was under consideration it was proposed to put on a certain young Assistant Engineer, but shortly out from home. Keen on his work, buildings as well as roads and bridges as one naturally credited him with being, one proceeded tentatively to congratulate him and oneself on the proba-

bility, whereupon he said in effect "Oh I hope not, I loathe the building." However our friend escaped on to 'Famine'. Of course there are men not a few in the Public Works Department who are as keen on building as even an Architect could desire, but any step this Committee can see its way towards rendering less possible the above type of tragedy, so much it would be to the benefit of the Department as a whole.

3,956. (*Specialized engineering branches and the Architect.*) As with the ordinary building works so with the more specialized branches of sanitary and electrical work. The Architect should have effective general control over the sub-contractors concerned in exactly the same manner as obtains at home. The lack of such authority means in practice that the contractor, when he wants to, can ignore the Architect entirely, trusting to the official wheels moving so slowly that his work will have gone too far to have it altered by the time the special officer can deal with it. At present the sanitary or electrical contractor can apparently spread himself on a building practically without reference to the Consulting Architect, though the more dire evils of that tendency have been mitigated by the personal courtesy of the officers concerned. The Architect should certainly be in, keep in, and be kept in touch with all specialized branches of building works at all stages and the contractors should also know that he will have a say in the final passing of the accounts. They, the specializing officers, know that primarily they have to satisfy the Chief Engineer who is the only person who really need matter to them. But they really ought actually first to have to satisfy the Architects who in the ultimate should be responsible to the Chief Engineer or the departmental Secretary for the whole building. Differences of view or opinion in the course of works would go to the latter officer for consideration and orders. To put it in another way, it should be as impossible for a specialist officer or contractor to "short circuit" the Architect as such an incident is unthinkable at home as between, say, the heating engineer and the building owner or client.

3,957. (*Final accounts.*) Accounts for building works payments to contractors, especially the final bills, should be submitted to the Architect for scrutiny. Were bills of quantities more thorough and were the drawings inspected and understood by the builder before tendering and did the builder realise all through the work that the Architect would be practically his final arbiter on accounts I am convinced that the saving to government would be considerable and would, as indicated above, tend to encourage the better type of builder or contractor for the execution of government works in these provinces.

3,958. (*Indenting for goods from England.*) Whether the cramped system of indenting for goods from England can be widened or swept away entirely I do not know, but in ordering special goods it would be a great advantage if the Architect could get into direct touch with the firm from which the goods may have to be ordered.

3,959. (*Official intercourse.*) A tendency to greater communicativeness between the Department Secretariat or the circle offices and the Consulting Architect's office would also be to government advantage. A project worked out complete goes up to government, or to a Superintending Engineer, for sanction and it may be months, many months, before a word is heard of its fate. If the Architect knew or could know, in the meantime that the work was practically certain to go on or that it was definitely shelved he might be developing it with interest against the day it was wanted on the one hand, or, on the other, give up spending time on it (even in his thoughts) and concentrate on something more to the point. Or a scheme goes to a Superintending Engineer and when one may have forgotten all about its existence an urgent wire comes to hand from the district engineer for so many copies of the drawings presumably for use on building operations. An Architect with a limited staff does not work to the best advantage on these lines.

3,960. (*Progress reports.*) Also the Consulting Architect's office should be kept informed regularly and

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accurately as to the progress made on works in hand especially in districts away from headquarters in order that (a) he may know the degree of urgency regarding the supply of detail drawings in advance as the work goes on, and (b) he may be the better able to time his visits and arrange tours to the best advantage. The instructions contained in Appendix XXXVII of the Public Works Department Manual of Orders may in many ways be pronounced as admirable though possible revision may suggest itself from the above notes or may be rendered necessary by the conclusions of the present Committee of inquiry.

3,961. (*The Consulting Architect's working instructions in the United Provinces.*) It may be convenient, for the Committee's reference, to set out here these instructions which were framed before my arrival in this country and which were handed to me in pamphlet form on my reporting myself for duty in October 1912 :—

(1). The Consulting Architect will be subordinate to the Chief Engineer, Public Works Department, Buildings and Roads Branch.

(2). The duties of the Consulting Architect will be—

(a). To advise the local Government on all estimates and plans for public buildings which require the sanction of the local Government or superior authority and also to undertake the preparation of such plans and estimates when called upon to do so. To advise and assist Superintending Engineers in the preparation of designs and estimates for public buildings which are within their own powers of sanction.

(b). To enter into direct communication with Superintending Engineers and, when so authorised by them, with any of their subordinate officers in regard to all matters of construction or decorative detail relative to public buildings in course of design or construction.

(c). To inspect important buildings while under construction and to offer such advice or recommendations as may be necessary.

(d). To submit an annual report to the local Government on the architectural work of the year in the province, with brief descriptions of the more important public buildings sanctioned or completed during the year.

(This report should reach government on the 30th June of the year succeeding the one to which it relates.)

(e). To prepare or edit occasional papers on professional subjects for the information and guidance of Public Works officers employed on architectural works.

(3). The local Government fully realize that the architectural importance of a design cannot always be gauged by the cost of the work. A comparatively small building costing possibly only a few thousand rupees may, owing to its intention and position, be architecturally of considerably more importance than structures involving a large outlay. The local Government therefore desires that in the interests of the improvement of the architecture of the country the Consulting Architect should be fully consulted, and has decided to place no restrictions on Superintending Engineers in regard to reference to the Consulting Architect of projects which are within their powers of sanction.

(4). It is impossible that the Consulting Architect with his limited staff can personally design all important buildings, though it is desirable that he should do so as far as possible, and therefore when a Superintending Engineer decides to consult him, the following procedure should be adopted :—

(a). The Superintending Engineer should ascertain in the first instance whether the Consulting Architect is able to undertake the preparation of full working drawings and details. If he should be unable to do so or if the Superintending Engineer on receiving his advice should decide that such a course is unnecessary, he may be asked to furnish sketches as a guide to the local engineer who is preparing the project.

(b). The pencil plans prepared by the local engineer from the Consulting Architect's sketches, or in accordance with his own ideas if the Consulting Architect has not been previously consulted, should be forwarded by the Superintending Engineer to the Consulting Architect accompanied by a brief specification.

(c). The Consulting Architect will then make suggestions for the consideration of the Superintending Engineer or advise whether the plans be accepted as they stand.

(d). If at this stage the Consulting Architect is of opinion that the design requires to be entirely remodelled, he will suggest for the consideration of the Superintending Engineer one of the following alternatives :—

(i). That a fresh design should be prepared in his office.

(ii). That he should furnish a sketch design if this has not already been done.

(e). A local engineer who is preparing plans from sketches or suggestions furnished by the Consulting Architect may at any stage correspond direct with the Consulting Architect or send the plans to him for advice. In any case it is desirable that the Consulting Architect should be given an opportunity of scrutinizing the finished pencil plans before they are inked in.

(f). In the case of projects involving expenditure which is beyond the power of final sanction of a Superintending Engineer it will be for the local Government to decide, after considering any suggestion the Superintending Engineer may put forward, whether the design should be prepared in the Consulting Architect's office or not, and in this case also the procedure above indicated should be adopted.

(g). In all cases in which the design has been prepared by the Consulting Architect himself or from sketches or advice given by him, he should be given an opportunity of seeing the finished plans and estimates before they are submitted for sanction.

(h). In order that the full benefit of the services of the Consulting Architect may be obtained it is further advisable that when he has been consulted regarding designs, he should, if his engagements permit, visit the town concerned, in cases where he thinks this necessary, either to inspect the site and surroundings and collect information about materials or to inspect the building when under construction. When a design which has been prepared by the Consulting Architect or in accordance with his advice has been finally accepted by the local Government or by the Superintending Engineer, it is important that no change should be made in it without his being consulted.

(i). The Consulting Architect will deal with designs for any public building which requires the sanction of the local Government or Superintending Engineer, irrespective of the source from which funds are derived for the construction or maintenance of such buildings.

3,962. (*Leave.*) So much for the professional point of view. There are a few points on the personal side which I feel the opportunity here offered should be taken to bring them before the Committee's notice. There is but one Consulting Architect in these provinces and under his agreement with the Secretary of State he is entitled to leave on the same lines as other civil officers, yet the cadre for other officers provides for proper margin for those going on leave in rotation or otherwise. There is no other Architect at hand or, so far as one can see, procurable to take over the Consulting Architect's work in these provinces during his absence on leave or sickness. This is a most improvident arrangement and, even if for no other reason, the permanent architectural cadre should be increased either locally or at Government of India headquarters in order that continuity in the work of the office may be assured when leave becomes due under the rules.

3,963. (*Examination of Architect before the recent Public Services Commission.*) It is eloquent of the present somewhat anomalous position of the Government Architect out here that not one of them appears to have been examined before the recent Public Services Commission. This may not have been actually the case but one can find no recorded evidence in the "Minutes relating to the Public Works Department" as published.

3,964. (*Private practice of Consulting Architect should be abolished.*) Private practice on the part of Consulting Architects ought to be abolished and the pay raised sufficiently to obviate the necessity of government's holding out the glamour of that delusive bait to those who would come to India. The present Consulting Architects probably agree on this without exception.

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[Continued.]

It so inappreciably affects the average income that government ought to recognise its emptiness and forthwith strike it off the terms presented by the Secretary of State to the President of the Royal Institute of British Architects when the latter is invited to nominate a man for one of these appointments. And were such private practice to become a real asset in the way of augmenting one's salary one would always feel the awkwardness of the clash of counter interests and were private commissions to begin to come in really nicely, not improbably (and, let it be allowed, not unnaturally) one might find government demurring to the sanction of fees.

3,965. (*Restrictions on private practice by the provision in the Manual of Orders.*) Further the potential scope in the way of private practice is narrowed by the provision (paragraph 8 of the Appendix) that the Consulting Architect shall deal with "all buildings requiring the ultimate approval of government irrespective of the sources from which the funds may be derived". This of course means that any building in which government has a fatherly enough interest to require to approve the designs, say for a private hospital, school, tomb, shrine or what not, the professional services of the Consulting Architect may be called upon not only to advise government on the proposal but to furnish designs in the capacity of Architect, free—*gratis*. That provision in the appendix referred to should therefore be altered.

3,966. (*Architectural private practice on the part of engineers.*) Yet another condition operates adversely on the face value of this 'private practice' in that it is found that the Public Works Department engineers themselves are allowed to conduct private practice (on permission) and to accept fees for services. Certainly no architect at home, without knowledge on the matter, would think to find himself in competition with the engineers in this wise.

3,967. (*Private agency for architectural work.*) Referring again to the question of giving work to private architects, I do not see what government is going to save or gain by so doing. Such architects could not be expected to work entirely for love, and personally I should be very glad to receive the ordinary percentage fees (in lieu of salary) on the building work turned out and carried through from this office. In other words the working cost of running the Consulting Architect's office is extremely low.

3,968. (*Expense of architectural work.*) What would give government pause to think would be to have an account for some Rs. 80,000 on a Rs. 12 lakh job. Yet that is the prospect they would have to face if work were given out to private firms. For I am told that a percentage of 7 per cent. is the least a private architect finds it pays him to take for designs and general superintendence under Indian conditions.

3,969. (*Comparative relative cost of government and private architects.*) The following figures may be illuminating in this connection :—

Cost of the whole establishment of this office (including rent, salaries, materials, travelling, etc.), since its foundation $4\frac{1}{2}$ years ago. Rs. 1,04,409 say Rs. 1,05,000 or an average of Rs. 23,332 per annum.

Estimate of return in professional fees (on the basis of fees ordinarily chargeable by a member of the Royal Institute of British Architects) for services rendered, (details will be given if desired) Rs. 2,62,292. Balance to the local Government in virtue of having their own architectural establishment (Rs. 2,66,292—Rs. 1,05,000)=Rs. 1,61,292. In other words government could comfortably more than double their present architectural establishment instead of employing private architects and still be half a lakh to the good over a similar period of $4\frac{1}{2}$ years. Or to put it in yet another way. Private architects, in order to compete successfully on business lines against the government architectural establishment, would have to work at fees about 150 per cent. below those they are professionally entitled to charge. It may be remarked (in parenthesis) that these figures also show an ample margin for putting the salaries of the Govern-

ment Consulting Architects on a more liberal footing. For I doubt not that returns from the other provinces would show a similar if not even more favourable position.

3,970. (*The delegation of work to private architects would adversely affect the recruitment of Government Architects.*) Nor, even if financially economical which the above figures show it is not, would it be expedient to delegate any of the better works to outside architects. If that were done and it became known amongst architects at home, as it undoubtedly would, it would have a deterrent effect upon the recruiting of Government Architects; for the proffered career would be at once shorn of its main professional inducement namely the scope and opportunity offered for work on a big scale that but rarely comes to the architect at home. Men worth having at all would simply not look at the prospect if they thought their real chances were to be blotted out by the best work or larger projects being given out elsewhere.

3,971. (*Allahabad High Court duplicated at Patna.*) An incident in one's own experience may be recited here as bearing upon the question of the recruitment of architects. I refer to the matter of the duplicating of the designs for the Allahabad High Court at Bankipore for the Government of Bihar and Orissa. The extreme urgency for expedition in the matter of their realising their High Court at Bankipore was no doubt the chief influence in it being decided to take over outright the designs and estimates as prepared for Allahabad. So flattering as it doubtless was to a certain extent to know that one's design found such favour that it should be sought to reproduce it elsewhere, this was tempered by some apprehension as to the ultimate result when it became clear that on the grounds of expediency the work was to be run up in materials other than those for which it was originally designed. The exigencies of building at Patna also, I suppose, prevented one having any say in the very considerable deviations made from the original design to get over the change in materials and other local conditions.

3,972. (*Honorarium to United Provinces Consulting Architect discountenanced by the Government of India.*) The Government of Bihar and Orissa wished to meet the case as far as it could and is understood to have expressed a desire to indicate its obligations to the Consulting Architect of these provinces (for—as the late Chief Engineer, Bihar and Orissa called it—"this act of sheer piracy") by offering him, through the local Government, at least an honorarium. This proceeding was however discountenanced by the Government of India and so the matter ended and is done with although, as I have said, I think it is an incident which the Committee should have before it as a side light to assist them in considering the present and future position of the Government Architects as attached to the Public Works Department in the several provinces.

It may be confidently asserted that no such similar case is within the experience at home of any member of the Committee in the dealings between any branch of government or a public body and an architect of a public building. I suggest that when government seeks the advice and assistance of the President of the Royal Institute of British Architects at home in the selection of architects for posts in India it should in its own best interests deal with such architects on the lines of etiquette obtaining between members of that Institute and government or the public at home. Otherwise, were this sort of thing to become known in London, it can scarcely be expected that the right type of men will come forward for service in India.

I feel that many of the points and details touched upon may be such that the Committee may consider outside their field of inquiry or concern. But my endeavour has been to show as nearly as possible how the Architect finds himself standing in these provinces in the belief that it may assist generally in the views and decisions that may be come to regarding the fate or future of the Public Works Department.

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ANNEXURE.

Notes in respect to paragraphs (vii) and (viii) of the Reference.

(*Professional education of students.*) Colleges in India can scarcely be expected to turn out fully qualified engineers any more than they pretend to do so at home. A student at home is usually content to consider himself still a student and to work like one—even though he may have passed through his college, got his 'diploma' and so on. One's impression here is rather that a student, down from college, is apt to consider himself above working—above taking his coat off—in the way that a student at home does if he means to get on. A private engineering or contracting firm could not entertain the application of a raw student offering himself as a fully qualified civil engineer. In order that he may get the idea of his career into a more approximately right focus and perspective the Indian student requires to recognise the hard fact that it is not only his college course nor a few months' practical experience but rather one of years that is necessary to fit him out. The student at home is often glad enough, in order to equip himself the better, to pay for his practical experience for a further term after leaving college: and it does seem to me that the Indian student has a tendency to look for too much being done for him instead of setting about to do it for himself. Government is probably more generous in employing the inexperienced engineer than it would be possible for a private firm of engineers to indulge in.

(*Architectural designs at Roorkee.*) I am afraid, on the architectural side, the custom of setting ambitious architectural subjects from time to time for the 'passing out' examination at Roorkee (if not elsewhere) tends to foster an exaggerated sense of self-esteem in the successful student.

Both from the engineering and the architectural point of view, i.e., in the best interests of the students of either profession, I think it is unfortunate that this 'passing out' subject is, in one year, engineering, in the next architectural—which means that there must be an unhealthy bias to one side or the other throughout the course of a student's college career for those who know they will be coming in, at the end of their time, for the

one or the other type of subject as the case may be, irrespective of their natural bent or predilections.

One has felt this in giving, as I do, at government's request, a short course of four lectures on architecture annually at Roorkee. In one year—the architectural one—the students are all on edge for ideas while in the other—the engineering—one feels one is being mildly tolerated or listened to on sufferance owing to the lack of a real objective which, after all, is only natural. Roorkee is, I take it, primarily an engineering college and it is a pity that a sort of architectural red herring should be dragged across the track of 50 per cent. of its output of students measured in years.

(*Engineering and architectural designs.*) I know that even the architectural subject has to be worked out with considerable engineering thoroughness but that is not the same thing as an out-and-out engineering problem such as I suggest they should have every year and also, every year, a much less ambitious architectural subject more within the scope of the students' architectural attainments and in a more proportionate ratio to the place given for the study of the subject in the college curriculum. In this way, though a student might perchance not be able to come out shining on the engineering side, he would at least have a chance of showing what he could do on the architectural. And so also, every year, architecture and engineering would go hand in hand as they should instead of as at present being more or less separated not only in reality which is bad but in the students' mind which is worse.

I well remember some four years ago, a Roorkee man coming to me with an incredibly and painfully ambitious design for an edifice on the strength of which he had, I understood, secured first place in passing out of his college. It simply missed being anything and everything it ought to have been though it displayed a perfectly amazing power and aptitude for assimilating though not digesting other people's ideas and I am afraid he thought he could, on the strength of these drawings, walk straight into one's office and take it really in hand. However the matter decided itself by his going on to works under the Department (at twice the salary he could have commanded here) and doubtless becoming a very useful officer.

I am no educationalist but it has occurred to me to offer these few observations upon one aspect of the Roorkee course and, though late and as an afterthought to my previous notes to send them in for what they may be worth.

MR. F. LISHMAN called and examined.

3,973. (*President.*) The witness stated that he was the Consulting Architect to the Government of the United Provinces and that he had 4½ years' service. He added that he had been recruited in England on a five years' agreement on a salary of Rs. 800—50—1,000.

3,974. Difficulty was experienced by him in connection with the requests made by officers owing to detailed lists of requirements not being furnished in the first instance. He was not prepared to say that such an event was a common occurrence as it depended a great deal on the manner in which the local officers concerned looked at the matter, but the remedy he proposed was that the local officers should be instructed to draw up a definite list of their requirements before they consulted the Government Architect, e.g., they should have a clear knowledge or idea of what they actually required in connection with the extent and arrangement of accommodation. He here cited the case of the project for a certain *kutcherri* building in which ten courts were required. The plans were passed by the local officers, and it was by a mere stroke of good fortune that the project had not been referred back to them owing to the view of a higher official that six courts only would be required for administrative purposes. It was, however, finally decided after further consultation to adhere to the original plans. He had quoted a similar instance in his written statement in which complete working drawings had been prepared to specific require-

ments for the Excise Department when the whole plan had to be remodelled to new conditions, and a third design containing further modifications had been asked for. The last named was, however, not pressed for on a representation being made that there was a limit to such procedure. The cases he had described were typical instances of cases in which the Consulting Architect should have been supplied in the first instance with a clear schedule of requirements.

3,975. It was desirable that the Architect should be brought into closer relationship with the departments for which he prepared designs, or with the officer who requisitioned his services. He had been rather fortunate in this connection in that when he was asked to design a building for a particular department or officer he had in most cases been able to keep in touch with the officer concerned, and provide for the requisite accommodation in his designs.

3,976. He had in his written statement set out the Consulting Architect's working instructions. These were contained in Appendix XXXVII, Part 2 (a) of the Public Works Manual of Orders which laid down that the Consulting Architect should advise the local Government on all estimates and plans for public buildings which required the sanction of the local Government, and undertake the preparation of such plans and estimates when required to do so. When he prepared the design for a building he generally also prepared the estimate. He

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had in fact done so in the cases of the three largest works constructed during his tenure of office, and it had until recently been almost the rule and not the exception. The present tendency however was now in the other direction, as, after the design for a building had been prepared the quantities were taken out and the estimate prepared by the Public Works Department in either the circle or district office. This course, in his opinion, was not a satisfactory one. Although the objection to the preparation of estimates by the Consulting Architect, *viz.*, that he had not as good a knowledge of local rates and of local building arrangements as the Executive Engineer, might be true up to a certain point, yet even so the Architect could readily place himself in touch with the district officer by visiting him and the particular site concerned. He could then discuss the question and obtain from the engineer his views regarding the prevailing district rates and having done so work out the estimates and send them to the officer concerned for remarks or observations. The preparation of his own estimates enabled the Architect to develop his plans and general scheme of construction simultaneously with the preparation of the estimate. It also enabled him to modify his design or method of construction in conformity with the local materials available and saved a great deal of time that might eventually prove to be wasted in his having to prepare a detailed specification and full and complete duplicate drawings for the district officer in order to enable that officer to prepare the estimate.

3,977. In addition to the preparation of designs in his own office he was required to scrutinize designs which had been prepared by other officers. This very often resulted in a great deal of unnecessary work, but he did not altogether agree with the view that it was undesirable to submit such designs as his experience was that improvements could undoubtedly be effected in most of the designs that came to hand for scrutiny. The trouble was that such designs were often practically completed before he had an opportunity of scrutinizing them and offering his suggestions. He therefore urged closer co-operation with regard to the first stages of proposed works, when it was much easier to influence the design and to save waste of time on abortive schemes.

3,978. He suggested that the Consulting Architect's sphere of action might also be extended to collaborating with the engineer in the preparation of designs for the buildings in connection with irrigation works. He felt that there must be instances in which architectural knowledge should be requisitioned, *e.g.*, in the designing of a large dam and its connected buildings. He believed the course he advocated had been followed in the case of the construction of such works in the Punjab and elsewhere. This was doubly important where such works formed a prominent feature in the landscape as was sometimes the case. There was scope for the Architect in bridge design and cognate engineering works and this was recognised to some extent in Europe. It was regrettable, in his opinion, that more bridge designs were not prepared by architects. The Tower Bridge had, as a matter of fact, been designed by an engineer with architectural ability.

3,979. He also recommended that the Consulting Architect should have executive control on works emanating from his office as was invariably the custom in England. He had at present no executive control and could only get things done by tact. Works whether large or small should be equally under his control. The supervision would still be with the engineering staff as representing the Architect, the Architect's visits being in proportion to the degree of importance of the work and its proximity or otherwise to headquarters. The assistance and co-operation of the engineer was however also essential in the Architect's office in the preparation of the designs of large important works, as the specialized experience of such an officer was of great advantage in assisting in the technical work of the Architect's office in working out the more complicated constructional problems. In England the architect almost invariably invoked the assistance of a consulting engineer for iron-work, reinforced work, and complicated roof and dome

construction where works of any magnitude were concerned. It was for such purposes that he had recommended the attachment of an engineer to the office of the Consulting Architect, and he had in the past applied to government for such assistance.

3,980. A quantity surveyor should be recruited from England and employed for a time in the Architectural Branch in order to ensure a more thorough and workmanlike method in the production of what was termed in England 'a bill of quantities' and which in India was known as an 'estimate'. The present method of estimating and working out quantities was not sufficiently good; and it would not as a matter of fact pass muster in England since it gave great latitude to contractors. The estimators were, in his experience, not quite up to the desired standard of quantity surveying. They did not appear to have had sufficient training and practice to give them facility in grasping and carrying out reliably a complicated estimate direct from a set of architect's drawings. The employment of a quantity surveyor for a short period for instructional purposes merely would effect the end he had in view. There would be difficulty, however, in recruiting such a man and in the event of such a contingency, quantity surveying might be done by a young Assistant Engineer recruited from England who had studied such work and had been attached to a quantity surveyor for training.

3,981. It was also desirable to recruit a few clerks of works who possessed a practical knowledge of building and had gained that knowledge by working with good contractors and good architects on the construction of buildings like the new Post Office and the extensions to the Home Office in London. The pay of such men was probably about 5 guineas a week, but he had no definite knowledge as to whether a good clerk of works could be obtained on that salary. The advantage in the recruitment of clerks of works for service in India was that such men were really specialists in building works. As such they had more experience of building works than came the way of the engineer in India, who often passed a considerable amount of his service in divisions where the construction of no large buildings was being undertaken. Such a contingency would not perhaps occur if he employed his own construction staff, but it was desirable that clerks of works should in the first instance be recruited for the purpose of instruction. The London County Council or the Office of Works might possibly co-operate with the Government of India in the matter and allow one or two of their clerks of works to come out to the country for a few years, on the expiration of which they would return to their respective appointments in England.

3,982. The Indian *mistri* was a man who identified himself with his work; he was brought up in it and desired to do what he could even if his intelligence had its limits. As *mistris* were keen on doing their best he desired to see them encouraged to take up some of the more responsible posts. He would not venture to say that *mistris* formed a satisfactory field for the entire recruitment of lower subordinates, but he believed that they actually did very often save the situation on works. He also did not wish it to be inferred that the lower subordinate, for whom he believed there was a great demand, was not useful, because such was not the case. He therefore recommended that a portion of the lower subordinate staff should be recruited from *mistris*, who, if they did not justify their appointment, should be reverted.

3,983. His experience of contractors in the United Provinces was that they were bankers rather than builders. There were a few notable exceptions, but he was unable to say what the percentage amounted to, and he desired that encouragement should be given to builder contractors rather than to contractors who were merely financiers and had no knowledge of building construction. Tenders were ordinarily invited for complete projects by the posting up of a notice in the office of the Executive Engineer, and any contractor whether he was a real builder or merely a financier could apply to carry out the construction of the work. In order,

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however, to ensure that the proper class of contractor was selected the Architect should be consulted with regard to the selection in all cases. It would be to the advantage of government if the banker-contractor were ruled out as government would then not have to provide so much specialized supervision and to employ so large a staff of their own engineers. All contractors before submitting their tenders should also be required to visit the Architect's or engineer's office for the purpose of examining the drawings and specification and be required to state in submitting their tenders that they had examined and understood the drawings and documents and were willing to stand by their estimates. Practical men would under such a system be given scope and the others would either be bound to fall out or to employ practical men in their firms. Such men could only undertake the construction of large works at present because they knew they could rely upon the Public Works Department for the necessary supervision. The contractors who had been employed on the construction of the High Court could be divided into two classes one of which were traditional builders, or at any rate good enough to be termed builders. The freedom of selection he desired to see introduced—might or might not be invidious; and even if tenders were submitted, one by a man who was not a builder contractor at 15 per cent., lower than that submitted by a builder contractor, it might prove to be best to accept the higher tender. The builder in England was expected to give a reasonable assurance, if not a guarantee, for the construction of his work. He was also required to show a record of the work previously executed by him and a list of men for whom he had worked. It was not the custom in England necessarily to accept the lowest tender.

3,984. He had found that there were men in the United Provinces who could be employed in the manufacture of brass-work such as door handles, bolts, etc., and he had taken considerable trouble in securing such men and they had turned out excellent work. In the circumstances, he recommended the freer local purchase of stores rather than their importation from Europe. Iron-work could also be manufactured locally and he had known of cases where iron gates had been purchased from England when there was no real necessity for so doing as had been proved by his recently having had some excellent wrought iron-work turned out by smiths in the United Provinces. Smiths working for engineering firms were able in some cases to start their own foundries. Government could therefore apply either to the engineering firms or to the craftsmen for such articles as were required. The Roorkee Iron Foundry was capable of undertaking iron-work to architect's requirements and this type of engineering firm should be encouraged.

3,985. Government should—as it did in the United Provinces—employ their own Architects and not rely upon private enterprise for its architecture, particularly, as was shown from the statement submitted with his written evidence, as it resulted in a considerable saving. Also, while government might in certain cases delegate work to private architects, it would be inexpedient to so delegate the better works as it would undoubtedly have a deterrent effect on the recruiting of men from home. Men would not come out if they saw that their real chances were likely to be blotted out by the best work or larger projects being given out elsewhere. Architects were at present nominated, on the initiative of the Secretary of State, by the President of the Royal Institute of British Architects. Consulting Architects so recruited should have had some considerable practical experience in England and be between the ages of 30 and 40 years. Men recruited as Assistant Architects should not be younger than 27 years of age so that they might have received a certain degree of experience in England and should have assimilated broad views. Architects should besides be Fellows or Associates of the Royal Institute of British Architects. This meant the minimum professional qualification required at present, otherwise selection was left to the discretion, insight and judgment of the President of the Institute. It was only equitable that government should offer Architects permanent and

pensionable service. Architects had hitherto been recruited on a temporary basis and it was perhaps only natural that they should have been so treated as their employment had been in the nature of an experiment. But he considered that all Consulting Architects should now have the option of accepting permanent service with a pension proportionate to their service and age. With regard to the objections that permanent service had a deadening effect on an architect and led to slackness in his work, and that it was undesirable that all the buildings in a province should be designed by one architect so that similarity might be avoided—that was a proposition with which the Committee could not expect him to agree as an architect flattered himself that he should be able to impart sufficient and appropriate variety to his work as occasion might afford. With regard to the other point he felt strongly that a man should have the option of permanent service after serving for a period of three years, government also retaining the power to dispense with his services at the end of that period. It was only reasonable that government should recognize both sides of the question; otherwise Architects would not after a time come out to India for a period of 3 or 5 years with the risk of their services being terminated at the convenience of government. English architects would be glad to come out to India for a period of 5 years' service where they had the prospect of designing large works provided government indemnified them for the loss of their practice in England, so that they might reasonably reinstate themselves on their return; it would certainly be unfair to return such men simply with what they might have saved in their provident fund at the termination of the period as there would be a considerable break in a man's career. As regards the objection that a man engaged for a few years was not conversant with the materials and the type of building required in a tropical country, and that he as a matter of fact did not become useful until he had served for a number of years in the country, he could not allow that that objection held as any architect in practice was always having to meet and adapt his work to new conditions of materials, climate, and so on. He therefore contended that an Architect should come out to India on a temporary basis for three or five years with the option of returning to England on the completion of such period or on the other hand, of being taken on to the permanent cadre. Under such conditions government would obtain the best possible work out of their men, who would be of a better class on the average. The chief inducement which encouraged good architects to come out to India was the scope they were likely to have professionally. Although their salaries were not too tempting, the comparative certainty of their position counted for something, particularly where a man might perhaps not have quite the same prospects in this connection in England.

3,986. With regard to the view that the ultimate aim should be to recruit Indians, who had received their training in a school of architecture which would be established for the purpose, in order that India might express herself in architecture, he did not agree that Architects recruited from England could not do full justice to Indian architecture but he did consider that there were men with architectural ability in India. He therefore thought that the time had arrived to afford facilities for the complete theoretical training in architecture of a certain number of Indians, by the establishment of a school for the purpose. The only places in which such a training could at present be obtained were the offices of architects, and so far as he knew, the School of Architecture in Bombay. He did not, however, know fully what the course of the latter consisted of.

3,987. The development and improvement of the School of Architecture in Bombay up to the standard of similar European institutions would probably be a difficult undertaking, as a practical and not an educational staff was needed for the purpose. The professors of the Liverpool Architectural School and the University of London were men who undertook practical work as well as their professorial duties, and it was impossible to obtain men of this stamp for the Bombay School

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[Continued.]

unless they were offered a sufficient financial inducement. He advocated that the proposed school of architecture should be established in a city where there were facilities for a technical engineering education in order that such education might be combined with the arts side of an architectural training. A school of architecture could not be attached to the Roorkee College. Although the syllabus looked rather formidable, he had seen some of the architectural work turned out there and he felt that the college were grievously on the wrong track. The examples the students were largely given to follow were those of the modern phase of the Indo-Saracenic style of architecture as produced in recent years in India, and they were required to digest these and produce designs of that phase of work. He had seen some of the drawings prepared by the students. They were not comparable to those prepared by young architects in England who had gained the same amount of experience in an architect's office or in a school of architecture. The designs prepared by the students in the Roorkee College were not of the same class, as the men borrowed their ideas from other peoples' work and put them down in an ill-considered jumble. Their draughtsmanship, however, was very good but it did not strike one as workmanlike. The Roorkee students should, however, be capable of preparing good designs, if they were properly trained.

3,088. (Sir Noel Kershaw.) All Architects should have the option of being made permanent, and government should offer all such men permanency. He did not know all the Consulting Architects in India, but his suggestion was not made altogether without knowledge as he had in the previous year, in connection with the renewal of his agreement with government, addressed all Consulting Architects with a view to ascertaining the position. He thought from the replies he had received on that occasion that all, except one, agreed that their appointments should be made permanent and pensionable.

3,089. Heads of departments in India should, before embarking upon a building project, define their general and specific requirements in a schedule of requirements. Such schedule should not, however, take the form of a printed circular, as every district and centre had its own requirements, and the administration was not sufficiently crystallized throughout the districts to admit of its use. It would be of great help not only to the Public Works Department officers but also to the Architect if administrative officers prepared their schedules of requirements more thoroughly.

3,090. He considered that dual service as Architect and contractor should not be permitted, and was of opinion that however honest and conscientious a contractor might be there would be times in the progress of every work when the interests of the contractor and those of government as represented by the Architect would clash. In other words, the Architect acted in an advisory capacity on behalf of government while the contractor was one who undertook a business contract for the construction of a building. Hence professional supervision on behalf of the building owner was necessary and where such supervision was alone exercised by the contracting agent, i.e., by one and the same person, there would be conflicting interests as indicated above. Palpable difficulties would also arise in cases where the Architect (the "contractor") was also the arbitrator between the owner and the contractor (the "Architect"). He had had no experience of an arbitration case in India, but he asserted that no building owner in England would have as his professional adviser and contractor one and the same person.

3,091. In the statement which he had furnished with his written evidence of the comparative cost of government and private architects he had allowed for the cost of engineers who had helped in the preparation of designs and calculations in his office. The 7 per cent. which had been referred to therein as the lowest rate at which a private architect would take up designs and general superintendence under Indian conditions did not cover the whole-time supervision of works, but merely periodical

visits. The establishment charges of his office since its formation; viz., Rs. 1 lakh approximately, included the whole of the time spent on the works by the Consulting Architect. This latter had been very considerable, but he classed such supervision as general superintendence and not full supervision.

3,092. An Executive Engineer and eight or nine Assistant Engineers were employed in connection with the supervision of the construction of the High Court. In addition a number of *mistris* were distributed over the works. The Public Works Department were of opinion that that number of men was necessary, but he considered it excessive and that it could have been reduced by one half. If the supervision of buildings was transferred from the engineer to the Architect, a whole-time Executive Engineer, one Assistant Engineer of two or three years' experience and two upper subordinates would be needed for works costing Rs. 10 to Rs. 15 lakhs.

3,093. (Mr. Mackenzie.) Architecture was distinctly a universal art though not in the same sense as music; though he was afraid he had scarcely studied music in the way he had tried to study architecture. Moreover, in these days, facilities for travelling and studying literature were so great that the architect's vision was greatly broadened, which helped from the point of view of the expression of Indian emotions.

3,094. With regard to the statement put forward by a certain Architect that although engineers thought architecture was a branch of engineering, building construction was as a matter of fact a very minor branch of architecture and that architects accordingly were capable of taking over both designing and construction, he thought that the whole matter was indivisible. Building construction had however become extremely complicated in many directions, and there was great scope for specialized engineering talent, and for co-operation with the architect. Some architect's minds and abilities might be so framed that they could undertake the work of the engineer, but he himself did not pretend to be able to do so in any specialized way.

3,095. In the event of an engineering adviser being attached to his office, rules would of course have to be framed outlining the various duties of the Architect and engineer. It would be unreasonable for the Architect to be expected to work out complicated engineering problems which were within the province of the engineer. It was therefore clear that the engineer should be responsible for his part of the work, but any notes that the Architect might make upon his work, together with his views, should be placed on record. This system would be workable as the engineer in England assumed responsibility for his part of the work, when called in by an Architect. The Architect was as a matter of fact responsible to his client and the engineer likewise to the Architect. Under certain circumstances a contract might be necessary between the Architect and the engineer but that would not apply in government service where departmental rules of procedure would govern the position.

3,096. He was not aware whether a certain Calcutta firm employed a quantity surveyor or estimator in connection with the construction of work.

3,097. (Rai Bahadur Ganga Ram.) He would designate the type of architecture adopted in the construction of the High Court as 'the flux of indigenous architecture on enlightened modern lines.' Such a style could not have been adopted out of India because it was directly the result of considerable consideration of climatic conditions and was practically beholden in much of its 'feeling' to the study of architecture in India.

3,098. If Architects were made permanent their work would not necessarily be of a monotonous nature, because if such work was executed on sound lines it would vary. The Executive Engineer who had been employed in connection with the construction of the High Court was not placed under the supervision of the Architect. He had perhaps occasionally misinterpreted the Architect's drawings, and if he had been placed under the orders of the latter officer the result would, he considered, have been more satisfactory. The Department, however,

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[Continued.]

had been fortunate in the employment of the engineer in question on the work. The dome of the building was constructed of an iron skeleton with a ferro-concrete covering and its strains and stresses were worked out in the office of the Consulting Architect by the Executive Engineer, who deserved full credit for the calculations.

3,000. It would take a quantity surveyor only a short time to become acquainted with the resources of districts. Such an officer would introduce correct methods of preparing bills of quantities, and although the methods in vogue in India were entirely different to those in vogue in England there should be no difficulty or trouble in this connection.

4,000. Although he was not free to undertake private work without the permission of government, government would have to tender a valid reason for a refusal in this connection as he was allowed this concession in the terms of his agreement. If government architectural work were handed over to the private practitioner on the basis of a retaining fee plus a percentage on works executed, it would not be to the advantage of government although it might be to the Architect. Moreover the work of the existing Architects was not of such a stereotyped style as to warrant the change.

4,001. (Mr. Cobb.) If he had had a free hand in connection with the employment of the staff for the supervision of the High Court, he would have engaged an Executive Engineer with about three Assistants. An architect in England carrying on work to the same extent as the Consulting Architect would engage the services of an engineer to assist and co-operate with him.

4,002. The rule in connection with the question whether a particular building should or should not be designed by the Consulting Architect laid down that the Superintending Engineer might request the services of that officer for the purpose. Hence its practical working depended entirely on the Superintending Engineer who, if he so wished, could himself entirely develop a particular scheme and this had, as a matter of fact, been done in some instances. It was unsatisfactory in that the Consulting Architect did not know in what stage a design, which had not come to him in the first instance, would ultimately reach him. The regulations were not always followed because schemes had in some cases been sent to him for advice after they had been fully worked out, even to detailed estimates.

4,003. He himself was at a loss to know what the financier contractor actually did when he had so many officers of the Public Works Department, including the Architect, to assist him in his work. Financier contractors were not petty contractors, but rather bigger men who undertook the construction of the larger works. The petty contractors were the more practical men and required less supervision and assistance and such men should therefore be encouraged. The financier contractor was really not worth the 10 per cent. he was supposed to receive according to the schedule of rates as he merely managed labour; in some cases as a matter of fact he was even relieved of this responsibility.

4,004. (Mr. Wilmont.) When he had stated he would in ordinary circumstances have employed only three

or four men in connection with the supervision of the High Court, he had assumed the employment of better contractors, but he felt that an excessive number of subordinate officers had been employed on the work. The records of the Department showed that from the end of December 1915, when two-thirds of the work had been completed, the staff had actually consisted of three overseers, and an Executive Engineer; and that prior to that date four overseers, one sub-overseer, one Assistant Engineer and one Executive Engineer had been employed, in addition to a few Roorkee students who were undergoing practical training, and he maintained that such a numerous personnel should not have been necessary.

4,005. There were advantages in the preparation of estimates in the Architect's office simultaneously with the preparation of the designs in that such estimates could be started whilst the drawings were being developed and thus save a great deal of time. Moreover, it might be desirable to modify the designs of parts of buildings and these could be carried out without entailing the necessity of returning the whole estimate.

4,006. If all major buildings were designed by the Consulting Architect the Architectural Branch would become a proper service. He was competent, with the experience he had acquired and the assistance of an engineering staff, the highest officer of which would be either an Executive or senior Assistant Engineer, to control architectural works. He would not necessarily eliminate the Superintending Engineer, but thought that the Executive Engineer was as a rule fully qualified to decide important questions of engineering construction. The fact that that officer was engaged with an Architect on the construction of buildings would not preclude him from seeking the assistance of the Superintending Engineer, but the Superintending Engineer would have no control over such an Executive Engineer while the latter was attached to the Consulting Architect's office.

4,007. If a small service of Architects were established and a famine arose, such officers could, when funds were reduced, be employed on the preparation of famine projects but he had not found that his office lacked plenty of work.

4,008. He had not considered a working scheme with regard to the recruitment of clerks of works for the educational needs of the province, i.e., the teaching of students by such men in a polytechnic school, but thought such instruction might be desirable provided the men in question could be obtained. His views regarding clerks of works had referred to actual works in progress.

4,009. He had been very glad at all times to receive the assistance of Public Works Department officers in connection with the preparation of designs for buildings, but he had of course had no experience as to how matters worked in other provinces.

4,010. It might be possible for the Superintending or Executive Engineer to discuss and work out schemes proposed by officers of other departments where such officers were not in a position to know exactly what they required, but he personally preferred to get into direct touch with such officers in the first instance.

KHAN BAHADUR MUNSHI HIRJI KHAN, District Engineer, Agra.

Written Statement.

4,011. (I.) Economy and suitability of methods of execution of public works.—At present plans and estimates for works are prepared by the Public Works Department on the requisition of the civil authorities, and are carried out under the supervision of this Department after such projects have been sanctioned and requisite funds are granted for their execution. The great advantage of the system is that the district engineer whose headquarters are at the revenue headquarters of the district frequently consults the local heads of departments on different points in the preparation of projects, and the requirements of the department concerned are fully provided for and carried out to their entire satisfaction. In addition to the imperial and

provincial works certain works and repairs of the district board are also carried out by the Public Works Department. They include the construction and maintenance of all metalled roads and all building and bridge construction costing more than Rs. 2,500 and maintenance thereof. All unmetalled roads and the bridges and culverts on them are maintained by the board direct. All buildings costing less than Rs. 2,500 are also constructed and maintained by the agency of the board.

(2.) For the execution of their works and repairs by the Public Works Department the district board pay Rs. 9,000 for establishment charges and Rs. 510 for tools and plant annually in the Agra district. For the construction and repairs of works direct under the

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board they keep their own staff (three sub-overseers) in Agra. The present system for the execution of civil works is quite economical and suitable. The establishment charges vary on the imperial and provincial works from 20 to 23 per cent. of the expenditure; for local works the percentage is less than this and these figures will compare favourably with the figures of any contracting firm for the preparation of projects and execution thereof. In large towns where every facility of work is at hand contracting firms may be able to do a little cheaper work, but the quality of their work cannot be as good as that of the Public Works Department. These figures include those works also for which projects are revised over and over again. It is believed that no contracting firm will revise projects in this way without extra charges each time and will not bear the worry to which the Public Works Department is subjected. The works and repairs are all carried out by the Public Works Department by contract and this system benefits the local contractors and local labour which is employed largely on the works in different capacities. In the present system all resources of the place are fully employed, while a contracting firm will manufacture most of the articles in their workshops at the headquarters and deprive the local men of the benefits which is really their share in the development of the country. A contracting firm will always desire to introduce their own patents in the estimates and thus raise the cost of the work, while the Public Works Department will use the best and cheapest materials which are locally procurable and will thus assist in the development of local industries. For instance Messrs. _____ will use their patent cement floor and the _____ Company will recommend malthoid roofing where the Public Works Department will use cheap concrete terrace or stone flags and brickwork, which are locally procurable. The result, if big contracting firms are employed in the execution of public works, will be that the profit will be divided between the contracting firms and the local contractors who will naturally remain the same as at present and the work will consequently be either inferior or more expensive than it is at present. The present rates of the Public Works Department only allow a small margin as contractor's profit. Private agency is unable to carry out work satisfactorily without outside supervision and it is fully employed at present in the contract system under the supervision of the Public Works Department.

(3). I accompanied the Chief Engineer and Executive Engineer to a certain college on 10th January 1917. The Chief Engineer had a long conversation with the principal of the college in connection with the employment of independent private agency in the execution of their works with the occasional supervision and professional advice of the Public Works Department. The principal said that he was quite afraid of employing private agency unless the works were under the Public Works Department as other government works, as the college had no expert on the staff to check the quality and quantity of work done and therefore they were liable to be cheated by any local contractor. As an instance of the case he mentioned the construction of a big college hostel and his residential quarters. These buildings were given out to a contracting firm and the principal stated that there was a lot of waste of college money and at the end they had to cut down Rs. 5,350 from the firm's bills on account of wrong measurements, etc. Further he stated that he had no confidence in the private agency or contracting firm unless their work was regularly checked and supervised by the Public Works Department. In this connection I append a copy of an inspection note by Mr. F. O. Oertel, Superintending Engineer, sent to the principal of the college on the bad quality of the work done by the firm (Annexure I). This document is an instance of bad work done by a firm of reputation. I also enclose copies of check measurements (Annexure II) showing differences between the bill of the firm and the actual quantity measured by a Public Works Department subordinate in the presence, I believe, of the firm's representative, of some of the sub heads of work in the college hostel and the principal's

bungalow. It will appear from those statements that a deduction of 5½ per cent. had to be made from the hostel bill and of 4 per cent. from the bill of the principal's bungalow on account of wrong quantities of work entered in the firm's bills. A comparative statement of the firm's rates at which they carried out these works and of the Public Works Department rates at the time is also submitted* for reference. The firm's charges were 12½ per cent. above the Public Works Department charges on the hostel work and 18½ per cent. above the Public Works Department charges on the principal's bungalow. This percentage is not very high for establishment charges, but the quality of work is decidedly inferior to that of the work generally done by the Public Works Department. This is the case of a concentrated work in a large town where every facility is available, but it is very doubtful whether contracting firms will undertake on such terms petty jobs out in the districts miles away from the railway and metalled roads where skilled labour is rare and difficulties of transport enormous. Another instance of inferior and more expensive work carried out by a private agency can be seen at another well known college in the province. I have had the occasion of examining the work in four blocks of hostels. The design is defective, containing unnecessary solid bastions of masonry which do not serve any purpose. The plinth is low and the site undrained. Doors and windows are very inferior, plaster and floor are unfinished. In my opinion a large sum of the public and private money has been wasted here for want of efficient engineering staff. This work was mostly carried out by another large engineering firm.

4,012. (II.) Encouragement of other agency.—As stated above, private enterprise is sufficiently encouraged, and at the same time local contractors are largely employed in the execution of public works and repairs and this is a great stimulus to the local artisans to come forward and to take up works of their own interest. It is quite feasible that the upkeep of the buildings (imperial, provincial and local) be entrusted to the various departments concerned, but the upkeep of roads (provincial and local) should remain under the Public Works Department as at present. For original works and improvements of buildings the local heads of departments should have powers to carry out direct petty improvements and alterations costing up to Rs. 500 with the professional approval of the district engineer of the district in the case of imperial and provincial buildings. In the case of district board buildings the limit of Rs. 2,500 should be adhered to as hitherto and any work of improvement costing more than Rs. 2,500 will be entrusted to the Public Works Department as hitherto. This will save the district board from employing an expensive engineering staff. In fact the existing staff of sub-overseers is sufficient to look after the repairs of the buildings in addition to their present duties. In order to see that the buildings of all departments are kept in proper order the district engineers should submit an annual report on the condition of the various buildings in the beginning of each financial year, and make recommendations for the reconstruction of unsafe parts, etc. This seems desirable to provide a proper check on repairs done and for the safety of government property. Beyond the limits above stated it is not quite possible for the local bodies and local heads of departments to carry out works without the assistance of an efficient engineering staff. Otherwise the work done will be inferior in quality and material and will result in a waste of the public money.

4,013. (III.) Charges in organization.—The present system of the organization of the staff of the Public Works Department is based on efficiency of work, but in some quarters it is urged that the offices of the Executive Engineers and Superintending Engineers are superfluous. In the present system a district engineer or sub-divisional officer has no power of technical sanction

* Not printed.

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of a project, but can give out petty works up to Rs. 500 on a piece-work agreement. In ordinary cases an Executive Engineer in charge of a division can technically sanction works up to Rs. 500, but can give out contracts up to Rs. 5,000, *vide* Public Works Department Manual of Orders, paragraph 158. A Superintending Engineer can technically sanction projects costing up to Rs. 50,000 and can sanction contracts up to Rs. 50,000. Beyond these limits the projects for works and contracts and certain works below these limits are sanctioned by the local Government in the Public Works Department.

(2). In my opinion the office of the Chief Engineer has enough to do and needs no modifications. Sufficient economy without losing efficiency in any way can however be secured if the divisional engineer's offices be abolished. The office of the Superintending Engineer seems an absolute necessity to ensure a proper check of the designs and estimates prepared and a proper control over the work done by the district engineers under him. If this proposal is carried out I would recommend that the ordinary powers of sanction and disposal of accounts and details of construction now delegated to the Executive Engineers be delegated to the district engineers and the special and personal powers of Executive Engineers, *vide* Appendix 31 of the Public Works Department Manual of Orders, should go to the Superintending Engineer.

(3). Each Superintending Engineer be assisted in his heavy office work by a personal assistant who may be a senior Assistant Engineer or an Executive Engineer. As the responsibilities of a district engineer will be increased by the change it will also be necessary that the charge of a district or sub-division be held by better men, i.e., Executive Engineers, experienced Assistant Engineers and specially selected upper subordinates who are not below the rank of sub-engineers.

(4). These modifications will facilitate the work of a district engineer, improve his relations with other departments and will result in quicker execution of works. According to my calculations there will be a saving of at least Rs. 21 lakhs a year in the establishment charges in these provinces by the adoption of these modifications, while the efficiency of the work will not be in any way impaired. These figures are arrived at after allowing for the pay of personal assistants for the Superintending Engineers and for the higher pay of district engineers.

4,014. (IV.) Relations with other departments and sub-branches.—The Public Works Department fully meets the needs of all other departments for all practical purposes, but the supervision of works and repairs exercised by the Department seems to me inadequate on account of the insufficiency of staff. The more a work is supervised the better will be the quality of it.

(2). The relations of the various sub-divisions of the Buildings and Roads Branch, sanitary, architectural, electrical and civil engineering are quite satisfactory as far as I know. I would, however, recommend that the execution of a work by more than one agency be avoided, as wherever the work of one branch or agency overlaps another friction is caused anyhow. The relations of the Buildings and Roads Branch of the Public Works Department with other departments are not as good as they ought to be. The reason for the friction is that officers of the Public Works Department are in most cases unable to carry out the wishes of the local heads of departments on account of the serious objections of the Accounts Branch and formalities of the Code rulings. In the present state of things any petty work or improvements urgently desired may take months or a year to be passed and carried out. Any improvements or alterations however small they may be cannot be carried out from the repair grant on account of accounts objections. For instance if a small quantity of brickwork or wood-work appears in a bill for repairs the question at once arises whether it is original work or repairs. So the hands of the Public Works Department officers are tied and it is out of their power to keep good relations with officers of other departments as the latter must naturally be annoyed

if their wishes are not carried out and their urgent needs for petty things are not provided.

4,015. (V.) Decentralization.—The best remedy for removing the friction now existing between the officers of the Public Works Department and those of other departments is that—

(a). The local heads of departments may be given the upkeep of their own buildings and be empowered to carry out petty improvements and alterations costing up to Rs. 500 with the professional advice of the district engineer.

(b). Ordinary powers of divisional engineers be delegated to district engineers to enable them to dispose of matters of a trifling nature on the spot. In these provinces some of the duties and responsibilities prescribed in the Code as those of Executive Engineers are already devolved on the district engineers. Further delegation of powers to the district engineers will be required under my suggestion made in (III) of this note.

(2). The district engineer or sub-divisional officer has no power to purchase articles of European manufacture in India. This is a great hindrance and causes unnecessary delay in the execution of work and repairs. This point deserves consideration. The facility of work demands that district engineers should have powers to purchase building materials of European manufacture in India on sanctioned estimates without any limit. Of course large orders for heavy machinery, etc., should be placed with the Director-General of Stores as hitherto.

4,016. (VI.) Simplification of procedure.—The Code rulings regarding the sanction and execution of petty works and repairs are rather restrictive, as it takes an unnecessary long time to get small jobs of even very urgent character sanctioned and carried out. The Public Works Department Code in my opinion requires to be altered in the light of my replies to the previous questions. The rules regarding the purchase of articles of European manufacture in India are unduly restrictive and, in my opinion, should be relaxed to enable quicker execution of work. The prices of Indian firms now compare favourably with those at which articles are obtained through the Director-General of Stores and the restrictions imposed by the rules are unnecessary.

4,017. (VII.) Education.—My personal experience of the college is rather old and I am perhaps not an authority on the subject, but one thing however seems to me quite certain that men of the subordinate classes from the Thomason College at Roorkee are not in most cases as efficient as they ought to be or as they used to be 20 years back. It seems to me that the present training is not solid but is more superficial and the student is slow in applying the instruction received by him in college to practice on the work.

(2). The present courses contain more theoretical than practical work. In my opinion the college training should be more practical and the professors and lecturers of the subject of civil engineering should be experienced engineers. In the subordinate classes students are appointed as teachers after passing their final examination without practical training of any sort. This practice is very undesirable. The appointment of a retired Chief Engineer as Principal of the Thomason College is a great improvement in this direction. A further and similar improvement is necessary in the appointment of professors of civil engineering as is done in the colleges of medicine. In my opinion it is desirable to introduce a course of architecture in every college of engineering in India as every engineer and subordinate of the Buildings and Roads Branch is required to have elementary instructions in architecture as it will help them in the designs and execution of works in this branch successfully. They are handicapped in this direction at present and their buildings are adversely criticised by Architects.

(3). The limited admission of students to Indian government colleges is a great hindrance in the progress of the profession in this country and needs consideration. In my opinion there should be more colleges of engineering in India than there are at present. It is desirable that an engineering Faculty should be established in every Indian University and adequate provision should be made for its teaching.

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(4). The admission into these colleges should be on the same line as in the other Arts colleges without any restrictions of number. The number, of course, will depend on the accommodation and the strength of teaching staff available.

4,018. (VIII.) Practical training.—At present there is no regular system for the practical training of students who come out from colleges. The government is only interested in the men who are to be taken into government service and the other qualified students have no chance of acquiring any practical training even at their own cost. Some provisions in this respect appear to be necessary.

(2). I would recommend that all qualified students of engineering colleges be allowed with the approval of higher authorities (Superintending Engineers) to work as apprentices with the district engineers for one year. After the expiry of one year they will either get employment in government service, municipalities, contracting and private firms, if considered fit, or leave their job as apprentices to make room for others who pass from colleges in the ensuing year.

(3). The present system of government guaranteed appointments should in my opinion be continued as hitherto as it secures the best men for government service.

(4). At present the apprentices from the college are either employed on survey office work or project making or miscellaneous jobs, and they do not give them actual practical training of the work. In my opinion, the apprentices under training should be given charge of small sections of work under the district engineer where they should be able to supervise the construction and repair of buildings and roads, prepare their own accounts and projects and manage the daily labour concerning their section. This kind of training will fit them better for the future responsibilities and independent charge.

ANNEXURE I.

To

THE PRINCIPAL,

—College.

4th December 1907.

DEAR SIR,

As requested by you I inspected this morning the work done by Messrs. ——— in the new hostel and your bungalow.

I am checking the measurements and accounts submitted by them, and will let you know shortly what payments should be made in order to close the account.

In the meantime I think Messrs. ———'s attention should be drawn to certain defects in the work which I noticed, with a view to their being remedied before final payments are made.

In your bungalow both the main and the verandah roof leaked very badly last rains, and although the cracks had been filled by Messrs. ——— they have opened out again, and you are sure to have further trouble with leakage. The concrete has apparently been put down very badly, and without sufficient watering. The only course I can suggest is that a new layer of concrete be put on (during wet weather if possible). I also notice that the rain has penetrated the walls in various places which again is a sign of inferior work.

In the hostel I specially noticed the inferior quality of the mortar used, as shown by the breaking away of the plaster in the walls wherever touched. Apparently the wetting of the lime was again neglected, and it has dried without setting properly. I am surprised that a firm of repute like Messrs. ——— should have neglected an important point like this, on which the excellence of the whole building depends, especially as it was pointed out to them by the district engineer, while the work was proceeding. The plaster they have

put up in the new hostel is bound to give continual trouble; already it is breaking away everywhere; the finials of the staircase newels have come off, and the pieces of tested plaster crumbled like dust between my fingers. The only satisfactory remedy would be to renew the plaster altogether, but as there will not be time to do this before His Honour's visit, and as it is desirable to close the contractor's account, I would recommend that 25 per cent. be deducted from the price of all the plaster (both inside and out) in the new hostel in order to enable the college authorities to carry out the necessary repairs to the plaster as they become necessary.

I fear the mortar in the walls must be also defective.

It struck me that there was general want of finish about work. The bolts and door fittings are by no means of very good quality, and the students complain with reason that they cannot close the doors properly from inside. I noticed in the hostel too that many of the roofs had leaked, and that the moisture penetrated through the wall behind the boys' book-shelves.

The whitewashing in the verandahs is not very even, and has been soiled by the *kunkur* running outside.

As regards the question of the plans which you referred to me, I am of opinion that Messrs. ——— could only expect separate payment for them, if they had not received the contract for building the hostel. Their own letter (dated 8th April 1902) shows that they are prepared for deduction from the bill of the amount already paid to them on this account, and their rates are so high that they could hardly expect to be paid the cost of the plans and estimates in addition to that of the building.

I am, Yours Faithfully,

F. O. OERTEL,

Superintending Engineer.

ANNEXURE II.

DEAR SIR,

I have carefully checked Messrs. ———'s measurements and bills, and I send herewith a revised statement of the amounts due to them for favour of approval by the committee and payment.

You will notice that the contractors' bills for the hostel and the principal's bungalow including supplementary account and cost of plans amounted to Rs. 82,688 while the bills as amended by me now stand at Rs. 77,329, making a total difference of Rs. 5,359 in favour of the college authorities.

This sum of Rs. 77,329 after deducting all previous payments I recommend for acceptance in final settlement of Messrs. ———'s account.

The contractors have agreed to the sum of Rs. 1,216 already paid for plans and estimates being deducted from their final bills and this has been done.

The previous payments I understand from you to amount to Rs. 73,756, therefore a balance of Rs. 3,573 remains due to the contractors. Of this amount I recommend the payment of Rs. 3,000 to be made now, and the balance of Rs. 573 to be kept in hand until after the next rains, and not to be paid to the contractors until they have made all the roofs water-tight, given a new layer of concrete to the roof of the principal's house, and made good any defective plaster in the hostel.

I have the honour to be,

Sir,

Your most obedient servant,

F. O. OERTEL,

Superintending Engineer, -

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[Continued.]

Statement of Messrs. _____'s account.

	Rs.		Rs.
Bill for hostel	63,780	Total for hostel	60,741
Deduct 5½ per cent.	3,508	Total for bungalow	16,588
	60,272		77,329
Add cost of carriage drive	469	Deduct payments made	73,756
TOTAL	60,741		3,573
Bill for bungalow	15,870		
Deduct 4 per cent.	635	Balance due	3,573
	15,235	Payments now to be made	3,000
Add supplementary bills	1,353		
TOTAL	16,588	Balance to be paid after completion of plaster and roof during next rains	573

KHAN BAHADUR MUNSHI HIRE KHAN called and examined.

4,010. (President.) The witness stated that he was a member of the Public Works Department and that he at present held the appointment of district engineer. He ranked as a sub-engineer and honorary Assistant Engineer. He added that he had been trained at the Thomason Engineering College, Roorkee, and that he had entered government service as an upper subordinate.

4,020. One of the difficulties under which he laboured was that he had to revise plans and estimates frequently, because civil officers repeatedly changed their ideas when plans were submitted to them for approval. He therefore suggested that administrative officers should be required to state their requirements as completely as possible in the first instance and that they should only be allowed to make slight alterations in plans subsequently and such as would not involve the recasting of an entire project.

4,021. The employment of large contractors was in his opinion an expensive practice. He admitted, however, that he had not had personal experience of such contractors, since he had hitherto only employed local petty contractors, and hence that his opinion in the matter was based on hearsay. But he remarked that he had cited instances of unsatisfactory and expensive work by large contractors in his written statement and that these supported what he had heard. In respect to one of these examples, viz., the college referred to, he admitted that he had not been employed in the town where it was situated during the construction of this work, but that he had been posted there subsequently; and explained that his remarks in this connection were based on what he had heard from other individuals and what he had gleaned from the correspondence and original papers recorded in the office of the principal of the college. The college was not a government but a private building, and certain additional structures, including those he had mentioned in his written evidence, had been constructed without Public Works Department supervision. The Department had, however, advised the principal of the college on certain occasions on the quality of work when they were requested to do so.

4,022. Neither the rates nor the total amount of an estimate were indicated in the notices inviting tenders for works, and only the sub-heads and quantities were made known. The notices were generally posted on boards in his office, but when large projects were concerned they were also advertised in the local newspapers. He usually invited tenders for entire projects. The largest work he had hitherto undertaken was the government high school at Agra, which cost about a lakh of rupees, and the work had been divided among four or five contractors as it was necessary to construct the school quickly and as the institution comprised several blocks of buildings.

4,023. Private enterprise was sufficiently encouraged at present, and he did not think it could further be encouraged by giving entire projects to single contractors. Except for such work as earth-work, large contracting

firms usually constructed the whole of their works, and very seldom sub-let portions of a work to petty contractors.

4,024. He suggested that all departments might undertake the repairs to their own buildings in order to relieve the Public Works Department. His suggestion had been based on what he had heard from the local heads of departments, e.g., the Collector of Agra had remarked to him that he was quite capable of looking after his works. The United Provinces Police Department at present undertook all repairs to police buildings, including those that had been constructed by the Public Works Department, and also the construction of small works costing up to Rs. 2,500, and the arrangement had proved satisfactory, so far as police buildings were concerned. He was not obliged to inspect work carried out by the Police Department, but the present District Superintendent of Police in his district had on two or three occasions sent him estimates for check. His experience had been that police buildings were on the whole maintained in fairly good order under the existing system. (Mr. Willmott here explained that residential police buildings and large *kotwalis* in cities were in the charge of the Public Works Department.) The witness added that the police *kotwali* in Agra was maintained by the Police Department.

4,025. He was averse to the transfer of the roads in the province to district boards as it would involve additional expenditure, and considered that all roads should remain in the charge of the Public Works Department. He was of opinion that the work would not be executed more economically than was the case at present, because it would involve the employment by the boards of the same staff as was at present kept for such work by the local Government in the Public Works Department. It was not the case that there was only one provincial road in the province. On the contrary there were many such roads which radiated in every direction. Another reason for his view was that the staff at present maintained by district boards, which generally comprised one or two sub-overscers in each district, was just sufficient for their own works, and he preferred to adhere to the present arrangement for the maintenance and construction of roads.

4,026. In respect to the suggestions in his written evidence for a reorganization of the Department, he advocated that district engineers might be given powers of sanction up to Rs. 500 at least. To the contention that this was a very small sum to suggest, he replied that there were a great number of petty works in districts which were worth less than this amount, and that powers up to Rs. 500 would be of considerable relief to district engineers since the latter at present possessed no powers of sanction. Except in the case of experienced Assistant Engineers, he was not inclined to suggest the delegation of higher powers even to such district engineers as held the rank of Assistant or sub-engineer.

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[Continued.]

4,027. In order to effect economy, he suggested that divisional engineers and their offices might be abolished. As there were 49 districts in the province at present and as each division comprised three such districts, the abolition of divisional engineers would entail the reduction of 16 appointments. Executive Engineers could then be placed in charge of the larger districts only, and sub-engineers in charge of the smaller ones, while Assistant Engineers could be placed in charge of the remaining districts according to seniority. Estimates were at present prepared by district engineers and submitted by them to the local heads of departments in the first instance for countersignature. They were then submitted to the Public Works Department Executive Engineer. It would be quite possible under his scheme, since the actual preparation of most estimates was undertaken by district engineers, for Superintending Engineers to check all estimates that exceeded Rs. 500; only specially large estimates were at present prepared in Executive Engineers' offices. To the contention that if his proposals were given effect to Superintending Engineers might be overworked, he replied that to obviate this disadvantage he had also suggested that such officers might be supplied with personal assistants to help them. He admitted, however, that the class of district engineers at present employed would require to be improved, but added that he had allowed for this contingency also in his calculation of the savings that he anticipated would accrue if his scheme were introduced. The pay of district engineers would be graduated according to the grade each officer occupied. He had not considered the alternative proposal to abolish Superintending Engineers rather than divisional engineers, but was not in favour of it for the reasons given in his written statement. If the Superintending Engineer's post were abolished, the divisional engineer would be delegated the Superintending Engineer's extreme powers, and he did not recommend this as sometimes junior men (Assistant Engineers) were made divisional engineers and the delegation of such powers to such junior men was inadvisable.

4,028. The present standard of subordinates who passed out from the Roorkee College, as shown by their practical work, was not as high as it ought to be. Many of them had not been through a course of practical training at all. For instance, though upper subordinates were posted to the Department for a year's practical training, temporary men were not trained in this manner and were merely posted direct to districts as overseers. Hence he considered that all students who passed from Roorkee, including lower subordinates, should receive a course of practical training for at least a year. Further, that only such students as had shown improvement at the end of the year should be sent out on works, while those who had not shown improvement should be retained for an additional year's practical instruction.

4,029. (Mr. Cobb.) He admitted that he did not desire it to be inferred from the comparative statement of the rates at which a private firm had constructed the college hostel, which he had furnished with his written evidence, that the Public Works Department would have constructed this building at cheaper rates. It was true that the Public Works Department rates he had quoted were less than those of the private firm, but the latter's rates included establishment charges while the rates of the former did not. He further explained that though the whole building had been constructed by the firm at a cost of Rs. 63,780, he had taken only the cost of a third of the building, which amounted to Rs. 23,394 into consideration as he desired to draw attention only to the comparison between rates and percentage. He also wished to represent that though the building might have been constructed at about the same cost by the Public Works Department, the private firm's work was faulty, and that the measurements which they had submitted to the college authorities were incorrect, and that these defective measurements had increased the charges of the firm by about Rs. 5,900.

4,030. (Rai Bahadur Ganga Ram.) Measurements of contractors' work connected with repairs to police buildings were taken by the *thanadar* and approved of by the

District Superintendent of Police. The cost of such repairs were charged against Accountant-General's bills in a lump sum for the whole district, and the Accountant-General's office did not check such measurements.

4,031. His scheme contemplated that the present work of divisional Executive Engineers would be divided between district engineers and the Superintending Engineers. But he did not mean to imply that the Superintending Engineer was a very lightly worked officer. He did not consider that the additional duties he had proposed would increase the Superintending Engineer's work very considerably owing to the fact that instead of dealing with four divisions the work of 12 or 13 district engineers would have to be supervised.

4,032. There were no *mistris* employed under him who had risen from the status of ordinary craftsmen to the upper subordinate grade, nor did he know of any such in the province. Very few of the *mistris* he had known were capable men. He therefore did not approve of the suggestion to replace lower subordinates by *mistris*, as sub-overseers, in his opinion, did more useful work than such men inasmuch as they were capable of preparing plans and estimates. Sub-overseers were quite as capable of supervising construction as *mistris* and after a few years were generally in a position to instruct their *mistris*. The *mistris* were employed on single works as skilled artisans to see the constructional details carried out according to drawings, the sub-overseer himself being unable to remain on a particular work the whole day. The sub-overseers were, on the other hand, employed on several works at a time and on surveys, levels, plans, estimates, etc., which were beyond the capacity of a *mistri* unless he was trained up to that standard.

4,033. Lower subordinates were not able to live honestly on the rate of pay that had been sanctioned for their lowest grade, viz., Rs. 30. He did not approve of the suggestion that the distinction between upper and lower subordinates should be done away with, and advocated that the latter might receive better rates of salary. There were instances in the province of lower subordinates having better qualifications than upper subordinates, but such cases were exceptional, and as a general rule lower subordinates had inferior qualifications to upper subordinates. If particular upper subordinates were considered unfit for further advancement they should be dismissed from the service.

4,034. (Sir Noel Kershaw.) The statement of the rates at which the college hostel had been constructed by a private firm as compared with the Public Works Department rates which he had submitted with his written evidence, furnished the rates that were prevalent during the same year and in the same district.

4,035. (Mr. Willmott.) He admitted that a great deal of time was involved in preparing projects in sub-divisional offices, and, as he had had no personal experience to the contrary, he thought work was always executed efficiently in such offices. Hence he did not consider that estimates could be better prepared in divisional offices. He admitted, however, that type designs might be more efficiently worked out in a higher office than that of the district engineer.

4,036. He thought that repair estimates were unnecessary in view of the fact that there were standard measurement books in each office. It was true that such measurement books covered only recurring items of repair work, but no estimate was necessary for the other items, since rough estimates only were at present prepared several months beforehand and it was not possible to work according to them. The contractors' bills besides would furnish full details of the items of repair work that had been carried out.

4,037. He made it a practice before inviting tenders to prepare a schedule of rates each year for all items of repair work, as far as possible. This schedule indicated the prevailing rates for each item, and was shown to contractors at the time tenders were invited, and the latter either accepted tenders on this schedule of rates or on rates above or below it.

4,038. His subordinates measured all repair work carried out by contractors and he checked their measure-

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[Continued.]

ments. Orders in respect to non-recurring items of repair work were given by him to his subordinates and

he presumed that a similar practice was followed in the other districts.

T. GAVIN JONES, Esq., EMPIRE ENGINEERING CO., LTD., Cawnpore, Representative of the Upper India Chamber of Commerce.

Written Statement.

4,039. I have the honour to submit, for the consideration of the Public Works Department Reorganization Committee, the views of the Upper India Chamber of Commerce on the subjects under inquiry by that Committee. In the opinion of the Chamber the present organization of the Public Works Department in the Buildings and Roads Branch is out of date and a thorough reorganization is necessary.

4,040. (Specialization.) The engineering profession today is highly specialized and, except in India, no engineer attempts to be an expert in such a wide range of subjects as comes under the purview of a Secretary to the Government of India or to the local Governments in the Public Works Department or to take charge of such a variety of works as are sometimes entrusted to Superintending and even Executive Engineers in the Public Works Department.

(2). Instances are not unknown of one officer commencing his career in the Irrigation Branch and filling successively appointments involving the discharge of such specialized works as canal construction, buildings and roads, agricultural engineering, mechanical engineering, well-boring, sanitary engineering and expert working on water-works and pumping stations, reverting finally to irrigation work. In another instance a Sanitary Engineer has been known to be appointed as Superintending Engineer to an important electrical undertaking.

4,041. (Separation of branches.) Such instances, which are believed to be not of infrequent occurrence, lead to amateur and uneconomical engineering and the Chamber strongly recommends the separation of the various branches of the Public Works Department and the creation of separate sub-departments and cadres for (a) Roads and Buildings, (b) Sanitary, including municipal engineering, (c) Architecture, (d) Agricultural, and (e) Electrical Engineering. The Irrigation Branch is already separate, and the Chamber recommends that this branch with the five branches above detailed, be, in each province, brought into direct communication with the local Government through one departmental Secretary to Government, who need not be an engineer, but preferably a member of the civil service and whose duties would be purely administrative. At the head of each branch or sub-department in each province there would be an expert adviser to government, who would be a highly paid specialist graded as a senior Superintending or Chief Engineer, brought in, if necessary, from outside the Department and who would have a free hand in all technical matters and in the promotion of the officers and subordinates of his branch. The various provincial Public Works Departments would be represented with the Government of India by a Secretary to Government, again a purely administrative officer who would have co-ordinating control of the provincial departments.

A technical Advisory Board with the Government of India might be a corollary to the suggestion, this Board having the final professional pronouncement on provincial projects where these were of sufficient magnitude to need the sanction of the Imperial government.

(2). The objection to this suggestion will probably be that recruitment to the various engineering cadres would be affected by the limitation of the highest professional appointments in each province to the grade of Superintending Engineer but this could be overcome by improving the status and salary of the senior appointments.

4,042. (Public Works Department Code.) The present system of recruitment and the training of the personnel are regarded as a hindrance to real progress. The Public Works Department Code is well known throughout the Department to be a mass of cumbersome and obsolete rules.

4,043. (Abolition of pensions and of promotion by seniority.) In the opinion of the Chamber the present system of promotion by seniority and the assurance of pensions are probably more destructive to efficiency in the engineering profession than in any other by reason of the fact that progress in the profession, outside the government establishment, is absolutely dependent on constant practice, study and struggle to keep up-to-date and in the forefront of the engineering development.

(2). It is feared that under the present system professional ability does not always spell advancement in the Public Works Department, nor, conversely, does lack of ability bring its proper consequences. To remedy this the Chamber are emboldened to suggest the abolition of pensions and the substitution of a provident fund system such as exists in private firms.

(3). It should also be laid down that merit rather than seniority should be the criterion for promotion.

4,044. (Relief from administrative work.) There is at present far too much administrative work thrown on the officers of the Department, and more specially on the higher officers who are swamped with administrative duties to the detriment of the technical work for which they are responsible.

4,045. (Private enterprise.) With regard to the encouragement of private enterprise, under the present system civil work is done entirely on contract, the greater proportion of it being done on what may be called sub-contract. This entails the retention of a very large staff of junior and subordinate government engineers and overseers necessary to supervise the many petty contractors employed.

(2). The Chamber strongly deprecates the system of petty-contract with its attendant evils and urges the giving out of large contracts to reliable firms, thus making possible a large reduction in the lower grades of the personnel of the Department.

(3). This system is adopted by the commercial interests of the presidency towns and the larger business centres up-country such as Cawnpore, and is found, certainly in Cawnpore, to result in lower rates and expeditious and reliable work. With a large reduction in the subordinate government staff, established and reliable firms of contractors will be found willing to tender for government contracts which under the present system they prefer to see pass them. With encouragement in this direction it is believed that in a short time it would be found that firms of contractors would provide themselves with the best engineering talent available and be ready to cope, as in the United Kingdom and in practically every country but India, with the largest and most intricate projects brought forward by government.

(4). It may be argued that government must execute all public works departmentally because no efficient private agencies exist, but in the estimation of the Chamber private agencies cannot exist against government competition where so large a portion of this work is for government.

4,046. (Architecture.) In regard to architecture, while recommending the retention of a separate Architectural Branch of the Public Works Department the Chamber suggest the continued and increasing encouragement of private architects, the gradual establishment of private architectural practice in the country by employment on government projects whenever possible, and the gradual elimination of Government Architects.

4,047. (Mechanical engineering.) In mechanical engineering the government is doing valuable work by the establishment of technical schools, but at the same time they discourage the establishment of private workshops by entering into competition with them.

(2). At present government not unreasonably look to private mechanical engineering houses to afford employ-

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[Continued.]

ment to students trained in government schools, but on the other hand the continued employment of departmental workshops in competition with private enterprise is a grave discouragement to the latter. The Chamber feel that they can safely assert that private enterprise can cope with all government needs, railways and ordnance excepted, if only it is not undercut by government workshops.

Mr. T. GAVIN JONES called and examined.

4,018. (President.) The witness stated that he was a member of the Empire Engineering Company, Limited, of Cawnpore; the firm took up mechanical engineering and iron structural work but not building work. He appeared as the representative of the Upper India Chamber of Commerce.

4,019. With reference to the Chamber's recommendation that there should be more specialization in the Department and that there should be six specialized branches, he explained that the underlying intention was that specialized duties should be more distinctly carried out than at present by the formation of specialized branches manned by men who were specially qualified and that each branch should work independently of the Chief Engineer and be self-contained. It was not possible to obtain the best standard of work from men who were not qualified for special work, and the present specialization in the Department was nominal as an engineer in the Buildings Branch could be transferred to a specialized branch and be placed under a head who had no knowledge of that branch. His main recommendations were (1) that specialized branches should not be under the Chief Engineer, (2) that specialists should be recruited direct for these branches and (3) that in place of a Chief Engineer for the whole province there should be a separate Secretary to Government who need not necessarily be an engineer, as an engineer Secretary to Government generally interfered with the work of specialized branches of which he had no knowledge while a non-engineer Secretary would be a purely administrative officer. He had known a Secretary to Government under the existing arrangement decide important questions in a highly specialized subject as electricity, without consulting the Electrical Adviser to Government. With regard to his second recommendation he explained that it had often happened in the United Provinces that the appointments to specialized branches had been filled by men without any specialized knowledge. He furnished two instances to illustrate this point in his written statement, one of which was that of a man who started as an irrigation engineer, was transferred to the Buildings and Roads Branch and then appointed a Sanitary Engineer, subsequent to which he was appointed a well-boring specialist and specialist agricultural engineer. He next became a specialist on water-works and pumping stations after a period of training in England and eventually reverted to the Irrigation Branch. Such instances were, he added, of frequent occurrence.

4,050. Of the two views (1) that the best method of recruiting specialists was to employ an ordinary civil engineer who had gained experience of the country and then specialized in a particular line, and (2) that for each of the separate branches a specialist from England should be recruited direct from England, he was in favour of the latter suggestion. He did not consider that a mechanical engineer should be recruited from the present Public Works Department engineers who had specialized in mechanical engineering, as he was of opinion that such an officer should be recruited direct from England, as also the Sanitary Engineer and other specialized officers. He did not agree with the view that sanitary engineering in Europe was very different from sanitary engineering in India, that a man with European experience was not of much value in dealing with Indian problems and that a knowledge of the country was of more value than specialized knowledge, as he was of opinion that a man who had received proper training in England and started with some experience there would be in a much better position to apply that experience to Indian conditions.

(3). The Canal Foundry at Roorkee furnishes a case in point. The old government shops were found uneconomical and were abolished. Private enterprise has taken them over. There are other government workshops which might with equal advantage and equal benefit be similarly abolished.

4,051. Promotion in the Public Works Department, especially in the higher grades, had been regulated in the past more with reference to seniority than to merit. In his opinion promotion should be regulated more freely by selection and this principle should be applied as much in the case of promotions to the post of Executive Engineer as in the case of promotions to the posts of Superintending and Chief Engineers. Appointment to executive rank should depend on merit alone and a junior should be appointed in preference to the senior if he was better qualified. It was true that the objection to such a system was that unless Assistant Engineers could be sure of rising to the highest appointments difficulty in regard to recruitment in England would be experienced, but such difficulty could be removed by making the service more attractive, and by improving the status of Superintending and Executive Engineers, also by abolishing the pension system and substituting a provident fund for it, so that a man who was dissatisfied on account of his promotion being withheld could draw his provident fund money and go elsewhere. He did not anticipate any difficulty in recruitment on these terms as private firms obtained their men on very much the same terms.

4,052. Engineers in private employ were generally engaged on short term agreements of three or five years and usually had a provident fund with 10 per cent. compulsory and 10 per cent. optional deductions, and 10 per cent. bonus. Private firms could on these terms obtain men who were as good and even better than those in the Public Works Department. Private firms practically paid their men at the same rates as government but they paid more in the higher branches of the service. Mechanical engineers were recruited at about the same age as government engineers and were paid according to the work required of them. He could not say what terms were offered to civil engineers as he was more acquainted with the terms of mechanical and electrical engineers, who were usually recruited on about Rs. 400 a month on a three years' agreement with the option, on either side, of continuing the arrangement and entering into a fresh agreement. This method was the only satisfactory one for government to adopt for their recruitment to the Public Works Department, as under present conditions a man obtained promotion in the Department by seniority irrespective of whether he was efficient or not with the result that very often the best men were left behind and by no means the best men got on well. He agreed, however, that the evil would be partially remedied if proper selection were exercised in making appointments to the grade of Superintending Engineer and seniority were altogether discarded.

4,053. The Chamber deprecated the system under which works were constructed by petty contractors and desired that the petty-contractor system should be altogether abolished, and that buildings should be given out on contract to large firms who could take up work on lump sum contracts based on rates, or to consulting engineers who could execute work for the Department at a certain percentage. Such a system would enable government to dispense with the services of a large number of officers who were at present engaged on supervising the work of petty contractors. He admitted, however, that it was the practice in the United Provinces to give out all public works as whole contracts and that, irrespective of the magnitude of a project, it was the ordinary procedure to call for complete tenders, and that it was thus open to any firm large or small to tender at a percentage above or below the rates; but he was of opinion that the system offered no encouragement to larger firms to tender

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[Continued.]

for the whole work as lump sum contracts were not given, which was the course he advocated. His experience in the United Provinces had been that the Public Works Department did not give whole contracts to one large firm but employed a large number of petty contractors. The only way in which to encourage private enterprise was to give building work to a large firm of building contractors and sanitary work to a firm of sanitary engineers. Though the Department at present called for tenders they managed the architectural and engineering work themselves. The employment of large firms would not lead to extravagance, but would on the contrary be more economical as it would do away with a good deal of the present supervising staff.

4,054. The ability of a firm to execute work without much supervision could be judged by the Executive Engineer and government might retain a register of contractors for the purpose; such register should not be limited to any particular firms. The engineer in charge of a work should also be at liberty to give work to any firm which he considered was reliable and have the option to reject the lowest tender if he considered that such had not been submitted by a reliable firm.

4,055. He could not say exactly how many firms of reliable contractors there were in the province which could be entrusted with large building works, but he was aware of two such European firms in Cawnpore.

4,056. He explained that the statement in his written evidence to the effect that the employment of larger firms would result in the lowering of rates had not been properly worded by the Secretary and that the Chamber had intended to say that the system would be more economical although it did not necessarily result in a reduction of rates. As a matter of fact, however, the mills and factories in Cawnpore got their work done at lower rates than the Public Works Department. He had made an actual comparison of the rates in this connection but could not specify them off-hand. He did not agree with the complaint that as the Public Works Department rates were low private enterprise was discouraged thereby. His experience had been that the private rates were even lower.

4,057. The system he had advocated would result in economy inasmuch as it would reduce the supervision charges of the Public Works Department owing to reduction in establishment. Such reduction would be effected mostly in the subordinate establishment, but partly also in the superior staff. He did not mean to suggest that firms should carry out work with only occasional supervision, but that Executive Engineers should supervise the work to the same extent as was done on the railways which did not employ a large staff of subordinate officials. He thought also that measurements should be checked by the Executive Engineers and not by the subordinate staff; this would not entail an increase in the number of Executive Engineers as detailed supervision would not be necessary in the case of large firms.

4,058. The architectural requirements of government should as far as possible be met by the employment of private firms of architects. Though this would not result in economy it would lead to a better quality of work. The change he proposed could be introduced by gradually dispensing with the services of the present Government Architects and relying more and more on private architects. He did not mean to imply that Government Architects did not do their best for the salaries they were paid, but that the best architects could only be obtained by competition. He was not aware of the practice in England, but although recourse to private architects might lead to larger expenditure he was of opinion that too much stress should not be laid on considerations of economy, particularly as the system he advocated would result in the framing of better designs and furnish wider scope for architectural talent.

4,059. In connection with the recommendation that government should not maintain workshops in competition with private workshops, he mentioned that the United Provinces had abolished the workshop at Roorkee as it had proved to be uneconomical, and that the Chamber's recommendation was that the other provinces

should do likewise. The Chamber had no complaint against the United Provinces Government in this connection as there was no government workshop in the province at present, there being only school and agricultural workshops at Lucknow, Cawnpore and Gorakhpur. The class of workshop the Chamber had in mind was the one at Amritsar in the Punjab and they desired that workshops of this nature should be abolished.

4,060. His recommendation in regard to the abolition of the appointment of Government Architect and the entrusting of architectural work to private enterprise applied to some extent to other branches, e.g., sanitary engineering. Hence sanitary works should be given to large firms of sanitary contractors, and government should consider the possibility of the gradual reduction of the appointments of Sanitary Engineers and the employment of private firms for the designing as well as the construction of sanitary works.

4,061. Highly trained specialists should be brought from England by government for supervision and as much of the work as possible entrusted to private enterprise. The Public Works Department would still remain as it would not be possible to do away with all the branches. It would however be possible to do away with the Architectural Branch if reliable architects established themselves in India.

4,062. (Sir Noel Kershaw.) The fact that promotion had in the past been largely made by reference to seniority rather than merit had not affected recruitment, as men joining the Department did not know the real conditions or that promotion would not be regulated by merit. If it were made known that promotion would be regulated solely by selection it would induce capable men to join the Department.

4,063. Overseers and sub-overseers should never be entrusted with the checking of measurements and such work should only be performed by senior officers. His suggestion was not based on the deficiency in the theoretical training of subordinates, but on their deficiency in character. Supervision also should be exercised only by the superior staff. This might lead to an increase in the number of Executive Engineers but detailed supervision would not be required if reliable firms were employed and a reduction in the present supervisory staff would be possible.

4,064. (Mr. Mackenzie.) He was not sufficiently familiar with the Department to say whether final measurements had ever been made by lower subordinates. When measurements were made by subordinates, however, they were supposed to be checked by an officer.

4,065. Mechanical engineers from Roorkee were employed by his firm, but they were not very satisfactory and he personally preferred to employ men from England. There were at present two Roorkee-trained men in the firm, both of whom were unsatisfactory. The England-trained man was better as he received more practical training and had a better character. An Indian who received his training in England was a better man all round. He was therefore of opinion that an Indian student who received his training in England was better than the Roorkee-trained man. He could not however suggest what period of training should be given in England.

4,066. (Rai Bahadur Ganga Ram.) The special branches which he had proposed should be centralized only to the extent that there should be a technical adviser to the Government of India to whom all projects should be submitted for technical sanction.

4,067. He did not mean to imply that government should incur additional expenditure in the encouragement of private enterprise, and was of opinion that the system he had advocated would be economical as it would result in a great saving in staff. Large contractors would engage their own supervising staff, and would be prepared to work on the 10 per cent. margin of profit at present allowed in the Public Works Department schedule of rates.

4,068. The practice in England was to hand over works to consulting engineers who charged 5 per cent. and were responsible for the proper execution of the

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[Continued.]

work. He admitted, however, that these consulting engineers employed their own clerks of works and that Executive Engineers would likewise have to employ some subordinate staff, but maintained that even then the present strength of the establishment would be considerably reduced as private firms could work on a lower establishment charge and generally carried out their work more expeditiously and economically.

4,069. He recommended that stores should be purchased solely in India, that the Stores Department of the India Office should be abolished and that government should rely on the Indian firms or British firms with offices established in India for the whole of their requirements.

4,070. (*Mr. Cobb.*) His firm was an engineering firm which carried out contract work, and was not a firm of consulting engineers as there was no scope for the latter in mechanical engineering. They employed reliable European foremen for the supervision of their works and such men were somewhat of the status of upper subordinates.

4,071. There was no great scope for engineers in the near future, and he preferred not to express an opinion on the subject whether government should take up the question of engineering education or leave it to private enterprise. The education imparted in the government engineering colleges was not sufficiently practical, and the idea of most of college students was that as soon as they finished their theoretical course they ought to get an appointment. Students in India put in two or three

years in a college and could obtain a certificate more easily than in England.

4,072. (*Mr. Willmott.*) It might be advantageous to split up the Buildings and Roads Branch into two branches, and to place architectural and buildings work under one branch.

4,073. There was no qualified architect at present in Cawnpore and there was not enough work there for an architect.

4,074. The scheme he had proposed for the creation of specialized branches would not necessarily lead to any overlapping of staff in any of the districts and the staff would not have to do so much travelling. In the event of famine, the men attached to the special branches would be quite as competent to supervise famine relief works as the present Public Works Department officers. Famine work did not require any expert knowledge.

4,075. The only method of retaining really good men in government service was by improving their prospects and making it worth their while to stay on. It was true it would be easier for good men to get away if they were anxious to do so under the scheme of recruitment he had proposed, but if the higher appointments were attractive the best would remain on to get those appointments.

4,076. He could not substantiate the remark in his written statement to the effect that the higher officers of the Public Works Department were swamped with administrative work, and remarked that the statement was based on what he had heard from some engineers in the Department.

W. G. WOOD, Esq., O.S.I., Principal, Thomason Civil Engineering College, Roorkee.

Written Statement.

General note on the Public Works Reorganization.

4,077. The Government of India wish by this Committee on the reorganization of the Public Works Department to make the Buildings and Roads Branch of the Public Works Department more economical and efficient. They state that their first object is to secure greater economy. But economy is, to my mind, closely connected with efficiency, and when efficiency is secured the result will automatically tend to economy. My long experience of the Department has forced upon me the fact that the efficiency of the Department has been most injuriously affected by the introduction of the provincial service in 1893. It had the effect of introducing two standards of efficiency, and I do not think that that was the intention. The idea was that men recruited in this country did not require the same pay as the expensive article from England. But the imperial and provincial engineers are all graded together, and all have the same duties to perform. It was, I believe, thought that the imperial engineers could be employed on the more important duties of the Department, relegating to the provincial engineers the duties of a more minor nature. But this, owing to the system of work in the Department, could not be carried out, although, as a matter of fact, the imperial engineers are put in charge of the most important divisions and districts and the less important are generally entrusted to provincial engineers. What has resulted is that men of the provincial service find themselves doing the same duties and taking the same responsibilities as their brothers of the imperial service on much less pay and on a different social status, and a feeling of injustice has been created. Moreover it has had the effect of lowering the standard required for an Executive Engineer, and flooding the service with a number of men who are not really fitted for the post of Executive Engineer if it is judged at all in accordance with the former standard. When I was Chief Engineer I had great difficulty frequently in deciding whether a provincial Assistant Engineer should be promoted to be an Executive Engineer or not. No standard of efficiency was laid down. If I took one standard only, that of the imperial engineer, in most cases promotion could not be given and the Assistant Engineer could only be promoted by taking a standard of efficiency far lower

than what was always formerly considered imperatively necessary. The Executive Engineer class is the backbone of the Department and it is a dangerous policy to lower its efficiency.

4,078. It is stated that, for the more minor operations of the Department, it is desirable that a cheaper agency than that provided by highly paid and skilled engineers should be employed. This criticism hardly applies to the United Provinces, at the present time, as most of the sub-divisions are now held by members of the upper subordinate service who are not highly paid, and whose integrity, I fear, is not above suspicion. Assistant Engineers are in charge only of the more important sub-divisions where big works are in progress; some of their time is undoubtedly taken up with minor works as well, but this is unavoidable, and does a young Assistant Engineer no harm. The *blé noire* of my existence, when an Assistant Engineer, was looking after the large expenditure which ordinary repairs were responsible for. It was not nice work, but had to be done, unless great waste of public money was to be allowed. I felt it was work from which I ought to be relieved. But I realized that unless the subordinates and contractors were properly supervised, there would be inevitable leakages of public funds.

4,079. Local bodies have already a small agency for the execution of minor works, and their powers have lately been somewhat increased. But the effect of that has not been to lessen the government engineering establishment, and the work done by the local bodies has, in many instances, been adversely reported on. Collectors of districts have frequently complained to me that the engineering staffs they are able to obtain are not equal to doing the small works with which they are entrusted.

4,080. It is stated that the Government of India's aim is to establish firms of reliable contractors willing and able to employ skilled indigenous agency and to this end to endeavour to attract to our engineering colleges a better class of entrant and to improve the system of their education. It is certainly most desirable that every endeavour should be made to attract a better class of entrant, but I fear that the method proposed will only result in disappointment. Will those Indians, who look to engineering as a means of livelihood, be attracted more by the fact that they will be able to get

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[Continued.]

employed by firms of reliable contractors, than by the prospect of being employed in a regular government service, with prospects of a steady rise in pay, and a pension?

4,081. If the cadre of the Public Works Department is reduced, we are taking away the very inducement which now attracts Indians. We have already taken away the inducement of the imperial service, which *did* attract good statutory natives of India, and whom the introduction of the provincial service has now excluded, as these statutory men will not enter the provincial service.

4,082. In the Buildings and Roads Branch the work has now expanded far beyond what it was 20 years ago, and the number of large and important engineering schemes, which this branch has now to cope with, are very different to former days. Throughout the province we have large water-supply, drainage and electrical works to attend to, all requiring the latest up-to-date methods, and the ordinary large building projects are far more complicated now than formerly, since far more important buildings, both in size and architectural treatment and with up-to-date fittings, are demanded now. Communications are being rapidly extended, and the advent of the motor has emphasized the necessity for better roads and a great many more bridges. The country is crying out for more and more engineers, and more skilled engineers.

4,083. In this connection it must not be forgotten that the Buildings and Roads Branch already employs large firms of good contractors and there are many Indian contractors who look to the Department for regular work and get it. Many of them do their work quite satisfactorily, and do not object to the Department's supervision. Some of our best contractors are men of the *mistri* class, who have raised themselves to positions of affluence by good hard work and who, by their former training and instincts, understand simple engineering. But they are not men who will employ their own engineers. For works such as water-supply and sanitary works involving machinery and pumps and pipes, etc., the Department employs the large European engineering firms who do employ trained engineers and in some cases they have Indian-trained men. But I have known many cases in which their own European engineers would much prefer to belong to the Public Works Department.

4,084. Regarding contribution works such as non-government school buildings, hospitals, etc., for which government gives a grant, these have been, in many cases in these provinces, designed and carried out by private agency after being passed by a government officer. But there have been complaints about this method.

4,085. Turning to the political aspect, if it is intended to reduce still further the European element and to employ mostly Indians, the question arises as to whether it is possible to secure a sufficient number of good Indian engineers, whether for government service or for employment with large and reliable firms. Such Indian engineers must be up to the standard of European engineers if the work is to be carried out as it should be carried out. There is a feeling extant that the administrative officers of the Department are prejudiced in favour of the European. This is not really so. A Chief or Superintending Engineer is quite willing to employ an Indian and welcomes him if he is as good as his European confreres. Unfortunately this is only rarely the case. It is no good shutting one's eyes to the fact that engineering as a profession does not appeal to the average Indian gentleman; very few of them possess the real engineering spirit and this is not to be wondered at when we consider the environment in which the Englishman and the Indian are brought up.

4,086. The young Englishman, if he has any engineering instinct, is surrounded from his birth by an environment which fosters the engineering spirit. He is given mechanical toys and throughout his young life sees all round him evidences of what engineers are doing. With the young Indian this is not so, and he grows up amid surroundings which do not tend to foster that engineering spirit which is essential, if a boy is to be turned into a successful engineer. If the European element is to

be largely eliminated, there will be a great danger of ill-considered schemes being carried out, and a waste of public money in making good bad projects.

4,087. It may be said that large schemes cannot be launched until they have been passed by the higher officers. But my experience is that there is a great waste of time and money already going on owing to the fact that very imperfect schemes are put forward after much time and labour spent on them, only to be scrapped by the higher officers and re-done. If the executive officers were more efficient this would not be the case, time would be saved, and the labours of the higher officers would be considerably reduced. Very much the same remarks apply to projects put in by private firms. They have to be very carefully scrutinised and in many cases entirely re-done, being unsound and badly turned out. Politically it may be necessary to employ more Indians, but it should only be done very gradually, by fostering the engineering spirit among them and only accepting those who really come up to the standard now required.

4,088. This carries one on to a consideration of the educational facilities in India for the production of competent engineers. I do not think it can be accepted that, at any rate in the Roorkee College, the education is not based on a sufficiently broad basis to attract first-class men.

4,089. When the college was open to the imperial service, it turned out men who have since attained to the highest positions in their profession and have a world-wide reputation. On the introduction of the provincial service, first-class men were not attracted, and it was not the fault of the education the college was able to provide that the Department was unable to obtain from the college the men it had been able to obtain in former years. In this connection I put up a note written by the late principal of the college on the question of the imperial and provincial service of engineers. (Annexure I.) It is here clearly shown that the education at the college is up to the European standard. Two remarkable instances are cited in which men who could not get an appointment to the provincial service from the college went home and got into the imperial service and a similar instance has occurred just lately in the case of a student of the civil engineer class who failed to qualify to continue the course at the end of his first year 1912. He proceeded to England and has now recently joined the imperial service.

4,090. In this connection I put up a useful note by Professor Sedgwick, of this college, with which I am in entire agreement. (Annexure II.) There is one suggestion I have to offer here and that is that when students are appointed as Apprentice Engineers the Department should take greater care than has perhaps so far been the rule, to have them really thoroughly instructed. What is required is brought out clearly in Mr. Sedgwick's note. An Apprentice Engineer is at present made too much use of, to the detriment of his instruction. I always tried to give the men appointed to me full experience on some large work. But the Executive and Assistant Engineers, under whom they were placed, did not always devote as much time to their instruction as was desirable generally, because an Executive or Assistant Engineer of the present time has so much work on his hands that he finds it difficult to find time to give much attention to young apprentices. The above remarks apply equally to apprentice overseers whose instructional course is very important.

4,091. As regards the reorganization of the Department itself, I am strongly of opinion that the time has not yet arrived when it will be possible to reduce the cadre. From my experience entirely the reverse is the case and the country is crying out for more and more engineers and moreover highly trained engineers. If the encouragement of large and reliable firms will help to attract first-class men, and supposing first-class men are obtainable from the colleges, then possibly the staff of the Public Works Department might be susceptible of reduction. But such a desirable condition is not likely to be attained

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for some long time. In the meantime is it possible so to reorganize the Department as to make for greater efficiency and economy?

4,092. At present there is a considerable overlapping of work, owing to the chain of officers through which a large project has to go. The sub-divisional officer does the spade work, the Executive Engineer works up the project and then it goes to the Superintending Engineer.

4,093. With more Assistant Engineers in charge of sub-divisions, time might be saved if they were permitted to send their larger projects direct to the Superintending Engineer. But in that case there should be no Executive Engineer over the Assistant Engineer. This would mean the abolition of divisions, the placing of all sub-divisions in charge of engineers and the creation of a few more circles. The sub-divisional officer might be either an Executive or Assistant Engineer, and he would correspond direct with the Superintending Engineer of his circle, and be personally responsible for his projects. This would eliminate the divisional officer and his office, and might conduce to acceleration in the time taken to put a project through. But every sub-division would require a gazetted officer. This would take away from the upper subordinate service the plums that they all look forward to and would not work in with the idea that the minor works of a sub-division should be looked after by a cheaper agency. Until the integrity of the cheaper agency can be assured I am very doubtful as to the actual cheapness, and if the public money is to be spent to the best advantage, it is inevitable that the highly paid man should do some of the drudgery, and although it takes up a lot of his time I do not think he is any the worse for it.

**Memorandum for the Public Works Department
Reorganization Committee.**

4,094. I have already submitted a general note on the subject to the Chief Engineer of the United Provinces, at his request. In this memorandum I propose to take the terms of reference in the order laid down in the notice sent me, and give my views on those subjects which fall within my scope of duty.

4,095. (I.) Economy and suitability of methods of execution of public works.—I consider the methods at present, adopted in the execution of public works, economical and suitable. All works of any magnitude in the United Provinces are done by contract, and tenders are called for in the open market. There are many Indian contractors who are quite capable, and have good command of labour, and some of them have quite a good practical working knowledge of engineering. Under proper supervision they turn out quite good work. Large works are sometimes done by one contractor, sometimes by several. It is, of course, much more convenient to have only one contractor from the point of view of the Executive Engineer, but in some parts of the province, especially in the hills, two or three men have to be employed. It is seldom that a European contractor can do the work as cheaply as an Indian contractor. As a practical example, the new High Court, Allahabad, just completed at a cost of Rs. 15 lakhs, was done by five Indian contractors. The iron-work of the trusses was supplied by Messrs. _____ and the iron-work of the dome by Messrs. _____. The work was well and quickly and cheaply done under very adverse circumstances.

(2). For minor works in outlying parts of the district no European contractor will tender, and the only way is to employ the local labour if it is to be done economically. It is frequently difficult to get outlying works carried out satisfactorily, as the Executive Engineer has not time to give much supervision to it, and unless his subordinates are very good men the work is frequently scamped. But the same thing would happen if the work was given to a European contractor, and could not be done at such cheap rates obviously, as an Indian contractor has not to incur such great expenses when visiting a distant work, and his staff is less expensive.

(3). The existing procedure, however, is in one respect susceptible of improvement, and in one which engineers

themselves would like to see altered. I refer to the rule laying down that the grants made during the year to a provincial or imperial work must be fully expended during the year. This has always been a source of trouble, as a bad contractor or a weak subordinate takes advantage of it to rush in bad work at the end of the year, trusting to its being passed owing to the necessity of spending the money before March expires. The matter is not one for the Public Works Department to put right, but for the financial authorities, and something should be done to improve matters in this respect as undoubtedly the present system puts the engineer responsible for good work at a disadvantage. He frequently has large sums of money thrown at him towards the close of the year, and does his best to get it spent properly. If, for various reasons, he cannot spend it all, and applies for another grant in the following year to enable him to complete the work, he gets blamed by the financial authorities for not having finished in time. This defect in the system is a real and genuine one and certainly does not tend to economy.

4,096. (II.) Encouragement of other agency.—If by private enterprise is meant the carrying out of works without outside supervision, then the present system does not give such enterprise much encouragement. I do not think the present condition of the country would justify public works being entrusted to contractors without departmental supervision. Minor works have, in many instances, been relegated to district boards, and I have had many complaints from Collectors and others about the quality of the work they are given and the inefficiency of the engineering staff they are able to obtain. Municipalities are more or less dependent on the Sanitary Engineer of the province for the proper carrying out of their large projects, and it would not be safe to entrust these to them without his supervision. I have had instances also of the preparation of large projects by outside firms, which would not bear criticism, and which had to be very largely amended and in some cases entirely recast. The salutary rule that all municipal projects must be passed by the Sanitary Engineer has saved many a municipality from very unprofitable expenditure. In the United Provinces an expensive agency is not now entertained for the district works and repairs; nearly all districts are in charge of upper subordinates on salaries ranging from Rs. 100 to Rs. 400.

4,097. (IV.) Relations with other departments and sub-branches.—I consider that the Public Works Department on the whole meets the needs of the other departments of the administration very efficiently. Difficulties, of course, occasionally arise, due principally to the personal equation, such as the struggles between a very energetic civil officer who wants to get some works done quickly before complying with all the orders, and an Executive Engineer who will not take any risks, and insists on all formalities being observed. But frequently the Public Works officer comes in for a lot of undeserved criticism, because a pushing civil officer objects to what he calls Public Works red tape. But this is seldom the case between keen and capable officers, as they will generally work together, and settle matters by personal interviews.

(2). There have been proposals among engineers to separate the Sanitary Engineering Branch from the ordinary branch. I have steadily opposed this, and think a free interchange of officers is very essential. It is a mistake to lose the opportunity of young engineers gaining experience with sanitary and water-works engineering, as well as with the work of an ordinary division. They soon pick up the work of the more scientific branch and afterwards are far more valuable to government when they rise to the higher grades. A divisional engineer, who has served under the Sanitary Engineer, is a far better engineer than one who has had only the experience of an ordinary division. In the United Provinces several of our young officers have been, and are now, employed under the Sanitary Engineer, and they will be most useful officers to government in future.

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(3). As regards architecture I always wanted to appoint a young Assistant Engineer as an Assistant to the Consulting Architect, but the cadre has been so reduced it was impossible ever to spare a man. So far the Architect has worked well with our engineers, and the results have been quite satisfactory. In the United Provinces the Architect has been held responsible for the designs, materials, and specification, and the engineer for the estimate and calculations in the large projects designed by the Architect. But if the large buildings designed by him were entrusted to private firms with only the Architect's supervision, I fear the Architect would not have sufficient time to look after the work, and it is necessary to bring in the assistance of the Public Works Department officers.

(4). As regards electrical work, the Electric Inspector has a fairly free hand, but it would be difficult for him to get on without the assistance of the engineers, and so far they have worked quite well together. He should, in the future, be assisted by an officer of the engineer staff to enable the latter to pick up the practical part of electrical engineering. I think it is sound policy to work all these branches of engineering as sub-divisions of the one department, and not make each sub-division a water-tight compartment by itself. If each sub-division is worked separately, and treated specially, it is very difficult to prevent discontent arising, and also to arrange for a regular flow of capable officers. Officers who show a special aptitude for any particular branch should be allowed to specialise in the branch, but should not on that account receive special advancement, but should go up in the ordinary way. The Public Works Department would then be self-contained for all classes of engineering, and the haphazard method of getting specialists out from home, and the difficulties of grading such men in the Department would be avoided. Instead of diminishing the cadre of the Department I would increase it to include a supply of officers for the larger municipalities. The present haphazard method of obtaining suitable men for the larger municipalities is not at all satisfactory, and the men themselves have not much to look forward to, and consequently they lose heart after a time. The engineering work in the large towns of these provinces is heavy and onerous, and a regular service of capable men through the Public Works Department would ensure the municipalities of a much better service than they have at present; an unsuitable officer could more easily be replaced and a suitable officer would be content.

4098. (VII.) Education.—I now come to the system of education in government engineering colleges. I am not myself an educationalist but, having lately been appointed principal of the Roorkee College, I may be allowed to express certain views which my short experience of the work done in this college has enabled me to formulate. I have given some general views in my note to government and I take this opportunity of putting down here the direction in which I think the present system could be improved, and by which its present broad basis could be expanded, and made more attractive.

(2). As a first step the college should be made an imperial college and provide engineers for the imperial service, whether or no the provincial service is retained or abolished. I have already said in my general note that the provincial service should be abolished from the Public Works Department if the Department is to be made efficient and have given reasons for that opinion. The college should be open to the whole of India. The next step is to remove the lower subordinate class and the textile class from the college to some other centre. This has already been strongly recommended by the Committee of Management. The next step is to reduce the age-limit for the civil engineer class to 19 years (at present it is 21), and to extend the college course to four years (it is now three). This is a recommendation that will probably be strongly opposed by Indians as will be apparent from the following considerations. At present students do not enter the college on an equality, that is to say, with the same standard of education. Those who have been to the University are

taken over the whole course of physics, chemistry, and mathematics (except applied mechanics), and go through it all again at the college, and consequently they possess a decided advantage at the start over those who have not been up to the University. There are a number of boys who cannot afford the University and yet have the makings of good engineers. But these subjects give, in the first year alone, the B.Sc. student such a decided advantage over the others, owing to the number of marks given, that the remainder have little chance of picking up in the engineering subjects. The B.Sc. students themselves say that to go over all the same ground again is a waste of time. It would be better to take the boys younger into the college, as they would then be all on an equality, and more impressionable, and the college authorities would be better able to weed out men thought unsuitable in the first and second years. This would have the effect of keeping out men who have no real engineering bent, and who simply come to the college after their university career as a means of entering a government service. I would alter the entrance examination, abolishing a classical language, history and Hindustani, and make mechanics, physics and chemistry, and drawing all compulsory. Marks for drawing should be increased. Drawing is an important subject for any man who wishes to be an engineer, and schools should be made to give greater attention to this subject for those students preparing for the Roorkee examination. A great many students are lamentably deficient in the subject on entering the college.

(3). The college course now covers such an extensive field that more time is really required to ground the students in each subject. Madras and Sibpur have now made their course a four year's one. There should be room for a certain amount of failures in the first and second year, in order that men, who are obviously unsuited for the profession, may leave the college while still young.

4099. (VIII.) Practical training.—Sufficient importance is not attached to the apprentice year's course. This, in my opinion, is a very important year in the young engineer's career, and all the students who pass out should get it whether they obtain a government appointment or not. As to who is to pay the cost is a matter for government to decide, but every student should get the benefit of it, and the Assistant or Executive Engineers under whom students are attached should be given some inducement to look after their training thoroughly. This is not always the case in my experience, due not so much to slackness on the part of the Assistant or Executive Engineer, but to the fact that he has so much work to do, he has not much spare time to devote to his apprentices.

4100. (Conclusion.) I have here given merely a rough sketch of how I think the college could be made more attractive and obtain more suitable students than it does at present. I certainly consider the standard of instruction high, and quite sufficiently advanced to provide fully qualified engineers for employment by government or private firms. It is not the educational system at the college that is so much at fault, but the difficulty of obtaining men who are keen on the profession as a profession.

(2). Colonel Atkinson in his note on the most modern methods of tuition in advanced engineering and mechanical institutions in England, written after visiting all the leading English institutions, says "as regards civil engineering training I am of the opinion that the scheme of education and the work done at Roorkee is well up to, if not in advance of, any work I saw in England." It may be said that Colonel Atkinson was biased, but he had many years' experience of Roorkee, and this deliberate opinion formed after seeing all the English institutions appears to me to be very convincing, and from what I have seen of the work myself I thoroughly endorse it. At the same time I think that a second professor of engineering is necessary, and should be recruited from the Public Works Department.

(3). What I have said above relates primarily to the civil engineer class. We have here also the upper subordinate class. This class is recruited from non-commissioned officers of the British Army, from European

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and Anglo-Indian civilians, and from Indians. The class meets the wants of the Public Works Department very well, and the students get a sound training.

(4). We have also a mechanical and electrical engineer class. This has only lately been started and is intended to meet the demand there is now in India, in the mechanical and electrical engineering professions, for men who, after training in a properly equipped institution, are willing to gain their practical experience by apprenticeship on a living wage, to work with their hands and to observe factory hours and rules, men *i.e.*, who are prepared to begin at the lowest stage and work up gradually. The class has not so far attracted many suitable men, as the advantages of it are not yet sufficiently widely known, but in time I believe it will supply a good type of well educated mechanic. There is a textile class here also, but its proper location is at Cawnpore and I do not suppose it will remain at Roorkee much longer. It is certainly not the place for it.

(5). In conclusion, I would like to add that there seems to be a general impression abroad that an officer in the Buildings and Roads Branch is primarily occupied with looking after the repairs of roads and a few buildings. This is an entirely erroneous impression. Repairs certainly take up quite a proportion of an Executive Engineer's time, but he is constantly at work on new schemes and new construction, and his charge is, as a rule, so extensive that it is all he can do to keep pace with the work. As for Assistant Engineers, the few imperial men there are all fully occupied with important work.

ANNEXURE I.

NOTES ON IMPERIAL AND PROVINCIAL SERVICE ENGINEERS.

1. It will be useful in the first place to examine the professional qualifications of imperial and provincial engineers as at present recruited.

Imperial engineers.

(i). Candidates are grouped under the following headings.
(a). Those who have passed the A. M. I. C. E. examination or possess an approved University degree in engineering (Regulations, paragraph 6).

(b). Those who have obtained such diploma or distinction in engineering as approved by the Selection Committee (Regulations, paragraph 6).

(c). Those who have taken no college course but should have had a full three years of practical experience (Regulations, paragraph 7). [This probably is included under (b).]

(ii). The A. M. I. C. E. examination is conducted by a series of fairly elementary papers on engineering subjects and is a good test of a satisfactory training in the elementary theory of some branch of engineering; but it is only a very partial test of engineering or professional ability since it is recognised that men with the same amount of paper knowledge may have widely different values as regards the practice in this profession. It is an examination that a number of upper subordinates passing out of Roorkee could pass with a little special preparation and a certain number have done so.

(iii). The University degrees, enumerated in Appendix I, are believed to be little better than the A. M. I. C. E. for the purpose of differentiating in practical training. The fact is that a practical test is a troublesome one to arrange, and requires a considerable amount of time which cannot be spared in the short time allotted to University examinations. Practical tests can, therefore, only be applied in the colleges where engineering students are trained, and since at the University examinations generally, rival colleges are presenting candidates, the University is unable to recognise any practical tests which have been made at the college.

For these reasons University degrees are a very one sided test of professional ability.

Further they are very different in arrangement and standard and under Appendix I it is possible that men,

who have prepared themselves for entering upon a career in electrical engineering, or naval architecture, may be appointed to the Public Works Department.

(iv). Under heading (c) a collegiate education is not required, *i.e.*, that it is not considered requisite for candidates to have received a scientific training or perhaps not even a good secondary education.

(v). From the considerations enumerated in the above three paragraphs, it seems probable that men of widely different professional attainments are likely to be appointed to the imperial branch of the Public Works Department.

(vi). Further, under the present system of selection, however much care is taken, candidates are selected whose appointments cause grave discontent and heart-burning among the engineers appointed in India.

The fact is substantiated by the details given in the next paragraph regarding two men appointed to the imperial service, one of whom passed out of the upper subordinate class of the Thomason College but not high enough even to gain a guaranteed appointment as a subordinate and the other who actually failed in the civil engineer class and was removed from the college.

(vii). The first man referred to joined the upper subordinate class in 1903, passed out 22nd in 1905 failing to get a guaranteed appointment.

He was appointed to the imperial service in October 1907.

The second passed into the civil engineer class from the Martiniers in 1902. He failed at the end of his first year, standing 20th, with 856 marks out of 1,930. He was appointed to the imperial service in 1909.

(viii). Provincial service engineers appointed from the Thomason College, Roorkee.

The college Board of Studies discussed in detail, in May 1909, the question of the comparative professional attainments of the imperial and provincial service officers at the commencement of their service. The opinion of the Board seems, therefore, worthy of quotation and is as follows:

"The Board is unanimously of opinion that if the standards of professional attainment were those laid down for the A. M. I. C. E., then students of the engineering class at Roorkee would be able to pass the required standard with ease. Judging from the syllabus of the Institute examinations for the associateship, the college courses at Roorkee, in addition to the compulsory part, includes the whole of the optional subjects, excluding the sections dealing with ship-building and heat engines."

As regards test of practical training, when the Roorkee College civil engineer certificate is compared with the qualifications required for imperial engineers a very different state of things is indicated. The college course extends over three years, each consisting of three terms, at the end of which practical and theoretical examinations are held and the student is required to qualify up to a certain standard at the end of each year and if he fails he is removed.

During the three years he goes through a long practical course in engineering survey, workshops, laboratories, note-books and drawing. In the first year 940 marks are allotted to practical work out of a total of 2,370. In the second year 1,010 out of 2,050. In the third year 930 out of 1,690.

Further in his third year the student is given a three months' independent project, which is intended to be a complete test of his training during his college course, and is made as direct a test of professional ability as possible. Free access to books is allowed and encouraged and the conditions are those of actual professional work. One thousand marks are allotted to this project.

Further the student has to undergo the spur of very severe competition. For 20 students admitted yearly by competitive entrance examination only 6 or 7 guaranteed appointments in alternate years are available. After completing the three years' course, 12 or 14 students are appointed in couples as Apprentice Engineers for a year on works. At the end of the year local Governments can

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appoint, under certain restrictions, whichever candidate is best fitted for the government service.

Another point worthy of notice is that students are specially trained for the Public Works Department in India and in the general practice of engineering as adapted by years of experience to the conditions of this country. At the outset of their careers they are familiar with the language and conditions of the country.

2. The Public Service Commission in recommending the formation of an imperial service and provincial service on different emoluments recommended that imperial engineers should be employed exclusively on work requiring high engineering skill while provincial service should be on works not ordinarily calling for high engineering skill. In other words the qualifications and education of imperial engineers should be as far above those of the provincial service as that of the imperial civil service is above the provincial civil service. As regards professional qualifications and education, after examining the preceding paragraphs it must be admitted that at present this state of things is far from the actual conditions at present in vogue. In fact it might very easily be argued that the qualifications of provincial engineers represent much more the standard required in an efficient Public Works officer than those of the imperial officer at present recruited.

There are, however, other requirements beyond professional qualifications and these are represented by the inherent attributes of the European race, which should weigh very heavily in the balance. It is absolutely essential that a large number of the staff of the Public Works should be of the European race and should possess those attributes difficult to define, but which are only produced by hereditary, youthful associations and training, and which may be summed up as the attributes of a gentleman. It is very hard to include these "other requirements" in any statement of qualifications required to justify the difference in pay now granted to imperial and provincial engineers of what we may call equal professional attainments. As, however, for efficiency a considerable proportion of Europeans must be appointed to the superior staff the question seems to be how can this be best done. The various possible lines of action are discussed below.

(i). If the present system of recruitment is adhered to, there seems no justification for the present difference in pay between the imperial and provincial officer and if adhered to, the qualifications of the former must be raised and of the latter lowered. This seems quite impossible as regards the provincial officer.

The pay of the imperial officers and of those appointed from the civil engineer class, Roorkee, must be made the same. Officers cannot be expected to work together without great discontent, with the same professional qualifications, doing the same work on different pay. The provincial service would then be a subordinate service reserved for students from the upper and lower subordinate classes, with a few special prizes to which men of exceptional abilities could attain.

(ii). Another course seems to be to leave the Indian officer as at present but to justify the increased pay of the imperial officer by requiring much higher qualifications as regards practical training and experience.

This could only be obtained by getting out much older men and insisting on at least five years' practical training at home, culminating in a competitive examination and moral qualifications. To induce these men to come forward and considering their probable age they would have to be appointed on a relatively higher initial salary, perhaps Rs. 600 to 800. Another scheme, which suggested itself on these lines, is in addition to a test of professional ability to hold a practical test of the experience of candidates on works. This is difficult to devise, but the following is a suggestion. The qualified candidates should be required to visit several works, etc., and write critical reports on these. A paper would be given supplying a certain amount of preliminary information with some guidance as to the points for criticism and in some cases, in this paper, alternative constructive proposals might be demanded to meet different circumstances. These papers could be of an entirely different kind to ordinary

examination papers as they would be worked out on the ground and not in the examination hall; the object being to test specially the candidate's appreciation of the effect of local engineering conditions and their relation to the cost, reliability, convenience, etc., of works. Candidates would be allowed the use of any engineering pocket books or others. In all cases it would be necessary that the tests should be assigned to candidates and completed in one day to avoid the risk of candidates consulting experienced engineers. At least three or four reports on works of different examiners to give a fair all-round test. These reports would be marked and candidates selected for admission to the Public Works Department by the total marks awarded. The marking would be based principally on the professional acumen displayed, but clearness of expression and efficiency in sketching would deservedly count for much. This would undoubtedly entail much trouble but would differentiate between those who had and had not undergone a satisfactory practical training.

If higher pay is granted to imperial officers it does not seem right that their practical training should be carried out on their joining the Public Works Department in India.

(iii). A third solution of the question seems to be to turn Roorkee into an imperial college, and make all men who wish to join the Public Works Department come out here and undergo their three years' course at Roorkee. Examinations would be held for entrance in England and in India, and a specified number of appointments reserved for each class of men. This was the system when Roorkee turned out many men who have since attained the highest positions in their profession and have a world-wide reputation.

These men would have the advantage of a training specially adapted to the requirements of the country, three years' training in the vernacular, and being "salted" to the climate in a healthy place and under careful supervision. The difficulties are obvious. Every man who qualified would have to be given an appointment and those who failed would have to be sent back to England. Roorkee would have to be thrown open to the whole of India; and the inhabitants of Bengal, Madras and Bombay who are at present excluded from Roorkee are notoriously good at examination and might swamp the inhabitants of Northern India. This could, however, be got over by a fixed number of candidates admitted from the various provinces.

In my opinion the advantages of this scheme far outweigh the disadvantages and it would result in government obtaining a very efficient service in which the numbers of the various races could be arranged at pleasure.

E. ATKINSON, Major, R. E.
Principal.

ANNEXURE II.

NOTE ON TRAINING OF ENGINEERS IN INDIA.

The Committee, recently appointed in connection with the Buildings and Roads Branch of the Public Works Department, have to consider, among other matters, the training given at the Indian engineering colleges and the question of broadening and improving it so as to suit the requirements of private firms as well as the government departments; as this touches directly on the curriculum at the Thomason College, I should like to deal briefly with the objects and procedure in training engineers and their application to Roorkee.

The mental equipment for all creative work, which is that having original features as distinguished from more routine, consists in the full development of the "imaginative" and "critical" faculties; the first of these provides the ideas or material which render creative work possible and the second is used in selecting from this material the most suitable, the result being original and successful work. These faculties are developed to a certain extent by general education,

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but are capable of very great development in a specialised direction; thus for instance the imaginative faculty is very highly specialised in creative musicians and artists and the critical faculty in the connoisseurs of these arts. The principal aim, therefore, of engineering education should be to develop these faculties specially as regards engineering. The importance of this specialised development in engineering is, I think, often not fully realised; the subjects taught at an engineering college differ widely as regards their educational value from this point of view and a careful selection and adjustment has to be made between them to get the best educational results.

The next point is to distinguish between education as just described and instruction in engineering; this distinction is of fundamental importance in connection with the training of engineers; the aim of instruction is to give the engineering student useful knowledge, such as data and the details of working of engineering processes; instruction appeals, therefore, principally to the memory and it is characteristic of it that, unless made use of comparatively soon after it is acquired, it is wasted, while education has always a permanent value; education and instruction are intermixed to some extent in all engineering subjects but the relative amount of them obtained differs enormously with the subject and the manner of its treatment.

A modern engineering training has two recognised stages, an engineering college course and an apprenticeship, generally taken in the order stated: it is now fairly obvious that the principal aim of the college course should be engineering education and that of apprenticeship to add the necessary instruction to produce a qualified engineer. An engineering college should always be able to maintain itself at the highest level in engineering education; this is, however, not possible as regards instruction in the details of engineering processes, since the instructors at the college must necessarily fall behind in their knowledge of the details of engineering practice on giving it up for teaching, and this is especially the case for highly specialised and progressive branches of engineering. Instruction also is much more effectual when obtained during apprenticeship than in the college, as it is acquired in a much more real and interesting manner and presumably also in the special branch of engineering which the student will take up; this cannot be insured usually in the college course. A certain amount of instruction, however, is essential in the college course to keep the subjects taught in touch with practice and to enable problems to be discussed which retain the interest of the students in engineering; if, however, the college course is to perform its highest functions the instruction given must be limited to what is desirable from the standpoint entirely of engineering education.

It follows, therefore, that the training in college is closely inter-connected with that given during apprenticeship and is dependent on it for its final purpose of producing a thoroughly qualified engineer, especially as after the college training the average student is useless to his employer, in an immediate sense, in proportion as he is highly educated and dependent on instruction to be obtained during the apprenticeship period.

The requirements for a satisfactory apprenticeship are—

- (a) That the apprentice should be placed on constructive work of an important and general character carried out under first-class supervision.
- (b) That the apprenticeship period should be arranged to give a sufficiently long and varied experience and solely with reference to supplying the maximum of instruction, without any idea of making use of the apprentice during this period.

Owing to the absence of many facilities available to British firms, it will probably be generally allowed that in both these respects apprenticeship in India has not been at all as satisfactory as that in Great Britain, in consequence this is reflected in the civil engineering course at Roorkee: it is almost a necessary and practically a universal consequence that when an engineering employer, whether a department or a private firm, finds a difficulty in giving an adequate apprenticeship, he will

demand and with some justice that a greater amount of instruction be given in the college course; the teaching of survey at Roorkee forms an apt illustration, the training in this subject is very thorough and complete at Roorkee and far in advance of that at any British college; it is not, however, a subject of much educational value in engineering, though highly scientific in some of its applications; the training therefore, in this subject for an engineer must rank mostly as instruction: this instruction has, however, probably been of great service to some departments of the Public Works Department and is undoubtedly due to their initiative.

In another instance the sequence just explained can be illustrated from the working of my own department at this college, that of electrical engineering; this may fairly claim to be the most scientific branch of engineering and it has, I believe as a subject, the highest educational value and I had always considered that it was introduced in the civil engineering course principally for this object, especially as the time allotted to it is very short; in 1912, however, a Board of Inspectors visited the college and on the initiative of its president, Mr. C. E. V. Goument, Chief Engineer, Buildings and Roads Branch, Public Works Department, it was decided to add an electrical project for lamps and fans in buildings to the civil engineering course; this entailed a considerable amount more instruction as compared with education than I had thought necessary, but I have endeavoured to supply this to the best of my ability in deference to the requirements of the Public Works Department.

My colleagues and I have always considered that the raising of the educational value of the engineering courses is of the greatest importance, and we have steadily worked towards that end, as could easily be shown at a suitable opportunity; I have also always considered that the views of employers are of the greatest importance, as it is necessary to rely entirely on them for providing the necessary apprenticeships; the only outstanding difference, I believe, between the Roorkee civil engineering course and those of British colleges is that a larger measure of instruction is given in it, and to that extent something is taken off its educational value; this, however, is partly compensated by a higher standard of work than that at an average British college; this fact has been illustrated by cases of students who have left Roorkee and proceeded to British colleges, details of some of these have been supplied to government, I believe, but during the last few months there has been the case of a student of the civil engineering class at Roorkee who failed to qualify to continue the course at the end of his first year in 1912; his failure was in the aggregate of marks required to bring him up to the Roorkee standard; he then proceeded to England and obtained a British diploma and has recently joined the imperial service, Public Works Department, Railway Branch.

The view appears to be held that if the work carried out by the Buildings and Roads Branch of the Public Works Department is handed over to indigenous private firms, this will provide a suitable opportunity for "broadening and improving" the engineering college training in India and bringing it more into line with that given in British colleges; it would seem evident, however, that these indigenous firms, for some years at any rate, will be in a much less advantageous position for providing adequate apprenticeships than the Public Works Department is at present; the argument here developed would, therefore, show that these indigenous firms would be the first to object to the broadened and improved courses, and would in all probability avow that the more highly educated but less instructed students are not at all what they require: in fact the change in the "employer" of the students is likely to prejudicially affect the college courses unless some such steps are taken as suggested in the succeeding paragraph.

I take now, therefore, the opportunity of stating my opinion, based on the reasoning of which an outline has been given, that the feasibility of increasing the educational value of the civil engineering course at Roorkee, which is probably what is referred to as broadening and

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improving it, is almost entirely dependent on the adequacy of the apprenticeship available for the students when they pass out of the college. I would, therefore, strongly urge that government should now make itself directly responsible for the apprenticeship stage of engineering training as it has already done for the college stage, through the instrumentality of the government engineering colleges.

Finally as regards an entirely different matter, I would point out that the competition for entrance to the civil engineer class at Roorkee is decidedly severe and that most of the Indian students entering are University graduates; it is, therefore, hardly likely that changes in the curriculum or those based on examinations will affect any appreciable alteration if the men who pass out of the Roorkee College are found unsatisfactory as a class; other methods than educational must be looked to, therefore, as likely to be most effective for an improvement.

ADDENDUM.

The general principles outlined in the preceding when applied to the improvement of the civil engineering course at Roorkee would lead, I believe, to certain changes which will now be explained.

Apprenticeships.—At present there are in alternate years 12 and 14 apprenticeships offered by government of one year's duration to the 20 students who may qualify in the civil engineering course; the apprentices are given a salary of Rs. 100 per mensem.

I would suggest that government should provide apprenticeships for all the students who qualify and take measures to render these satisfactory. It has been pointed out that the apprenticeship training is complementary to the college training and essential to produce a qualified engineer; the extra expense to government, in completing the training by apprenticeship of the students now unprovided for would be very small in comparison with that already incurred in giving them a college training; this procedure, therefore, seems a very reasonable sequel to the policy to which government has committed itself by maintaining the Roorkee College; any difficulty in finding satisfactory apprenticeships could be met, I believe, by the measures suggested later.

The salary of Rs. 100 per mensem paid to apprentices should be termed a scholarship, since the giving of a salary confuses the very important distinction, as far as nomenclature can, that the apprentices are under training and not under employment. It is unnecessary also that scholarships should be given to all the apprentices, these should be prepared as in Great Britain to pay for their training to some extent; scholarships to apprentices might, therefore, be offered to the first ten on the college list of qualified students; this would be in consonance with the practice at the college as regards the newly started class in mechanical and electrical engineering.

For satisfactory results in apprenticeship, it is very important that the engineer, under whose direct orders the apprentices are placed, should receive an allowance; the supervision of an apprentice, so as to provide him with a proper practical training, is a troublesome addition to an engineer's ordinary duties and of a character entirely different from them; the supervision should therefore be paid for on the sound principle that, under these circumstances, this is the most effectual method of inculcating a feeling of serious responsibility as regards it.

It would be an excellent thing if the apprenticeships offered by government could be with private firms as well as on government works, when suitable opportunities present themselves; in this case the allowance for supervision of apprentices should be paid to the firm on their undertaking it would go to the engineer under whom the apprentices were placed. With a view also to facilitate the obtaining of apprenticeships for the college students with private firms, I would suggest that in every large government engineering contract a clause should be inserted declaring that the firm is willing to take apprentices to a reasonable extent from the Indian engineering colleges; the insertion of this

clause would be quite fair to the firms and a good deal less onerous than the "fair wages" clause in British government contracts: this point was raised by me some years ago through the principal of this College, without any result, as far as I know.

Finally as regards apprenticeship, strict regulations should be laid down as to the responsibility of engineers for providing apprentices under them with satisfactory opportunities for practical training and to ensure that their training will be the only consideration in arranging their work; the object of apprenticeship also should be more explicitly made known to students than it is at present, since an apprentice is inclined to be only too eager to be put in independent charge of any kind of job without realising the disadvantage to his training.

Roorkee civil engineering course.—Assuming that all students could obtain a thoroughly satisfactory apprenticeship, the civil engineering course proper could be greatly improved in educational value by the removal of instruction in details of elementary engineering practice now largely present in it, the amount of instruction being limited to that necessary for engineering educational purposes; the requisite modifications could, I think, safely be entrusted to the professional staff at the college.

An important point as regards this course, that should not be lost to sight, is the desirability of maintaining a close and properly co-ordinated relationship between the training at the college and that on apprenticeship; this, I think, may have been somewhat overlooked. In Great Britain the staff of engineering colleges are largely concerned in the selection of apprenticeships for their qualified students and in some cases inspect them during apprenticeship. With this object in view I would suggest that brief particulars of apprenticeships proposed should be submitted to the principal of the college and approved by him, before students are posted to government engineering departments, etc., as apprentices; also that the principal be empowered to arrange apprenticeships directly with private firms, the sanction of government being obtained, if considered necessary, before posting the students. With the same object in view, I will add a further suggestion that might be effective, this is that government should offer say a gold medal for a thesis or paper written by an apprentice and based on experience gained during the apprenticeship period; the engineer under whom the apprentice works should certify that the matter in the paper is directly connected with his training and is the apprentice's individual work as far as the engineer is aware, the latter should also be attested to by the apprentice. The papers submitted should be examined for awarding the gold medal by the professor of civil engineering at Roorkee and for this work he should be given an adequate fee. The medal might be named after some distinguished Roorkee alumnus and government should endeavour to give it honourable recognition by mentioning it with the holder's name in official lists, etc. This procedure, if it can be made effective, would have the useful result both of drawing greater attention to the importance of apprenticeship training and also of keeping the college in touch, through the professor of civil engineering, with the general characteristics of the apprenticeship training obtained by its students.

Roorkee survey course.—The work of survey is very different from that which is accepted as engineering in the ordinary sense, though it is intimately connected with certain kinds of engineering. The special importance assigned to survey at Roorkee has been referred to already, the excellence of the instruction in this subject has been often commented on and it is an accepted feature of the civil engineering training at Roorkee that all students are to be turned out finished surveyors; the time and application devoted to this subject necessarily take off from the educational value of the training as compared with that at a British college; there are however undoubtedly weighty reasons for this feature at Roorkee and any half measures in this matter would, I believe, be a mistake; it is a case for one thing or the other. The general principles laid down indicate that the formation of a special Survey Branch of the Public

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Works Department would be the only procedure that would entirely remove the reasons for this characteristic feature at Roorkee, for, under these circumstances, there would be no difficulty in giving adequate instruction in this subject, as apprentices or probationers, to the engineers who intended to take up this branch: if this procedure were not contemplated, any radical changes in the survey course appear to be ruled out.

Specialization in engineering.—In connection with the general principles outlined and with particular reference to the argument at the end of the last paragraph, I would like to point out that a higher degree of specialization in engineering work places an engineering college in a better position as regards its own work, since the conditions for apprenticeship are much more favourable, it being much easier to train an apprentice satisfactorily for specialized work than for miscellaneous; in addition specialized work is associated with continual and relatively rapid improvements in the details of its practice, so that engineering employers are led to prefer giving

the instruction necessary themselves during apprenticeship to the engineers they intend to employ, instead of depending at all on the necessarily more or less out-of-date instruction obtainable at a college; in consequence the college is naturally brought to concentrate on its proper function of engineering education. When comparing therefore Roorkee with British engineering colleges, the greater specialisation of engineering in Great Britain should be taken into account.

Finally I would explain that in referring to education and the educational point of view, I have in mind the view point of an educated engineer towards engineering education; this is often widely different from that of educationists or educationalists as they are variously termed.

F. W. SEDGWICK, M.A. (CANTAB.),

Mem. Inst., Electrical Engineers,

Professor of Electrical Engineering,

Thomason College, Roorkee.

Mr. W. G. Wood called and examined.

4,101. (President.) The witness stated that he was a retired Chief Engineer of the Public Works Department, and that he had been principal of the Roorkee College since the 20th October 1916 previous to which he had had no experience of educational work.

4,102. Firms of contractors were sufficiently encouraged under the existing procedure of the Public Works Department. The ordinary form of tender generally used in the United Provinces was one of rates, but lump sum tenders were also in use. He had had very little experience of the latter form of tender as it had not been encouraged because it eventually led to trouble. For instance, in a rate contract, if the quantity of concrete in the construction of a bridge was exceeded, it could be measured and paid for at the correct rate, but if the contract were a lump sum one, the contractor had a complaint as very often the extra quantity would not have been measured before it had been put in the work. Even in England, where a great deal of lump sum contract work was carried out, such difficulties were sometimes met with and alterations then had to be made. If a schedule of rates was laid down in a lump sum contract and agreed to, however, such difficulties would be avoided. When a man accepted a lump sum contract, he took the risk of having to do more work than he anticipated. For instance, if a bridge was built on a lump sum contract, the contractor might have to sink his wells very much more than had been allowed for in his original rough estimate.

4,103. Although such cases were exceptional, instances had occurred in the province in which large contracts had been split up. A case in point was that of the High Court, the contract for which had been split up into five parts as the Department had anticipated that work would be expedited by that method. In other similar instances a bonus had been given to the contractor who finished his work first with a view to the expedition of work. If one large responsible contractor had been employed on these occasions, it would have depended on the personality of the contractor whether the work would have been constructed sooner than by the method actually adopted. He added that as a matter of fact he had had work completed in time by the employment of one contractor and that his experience in this connection had been satisfactory. A good Executive Engineer generally possessed a number of good contractors who were capable of undertaking the construction of large works, and these, of whom there were several in the province, looked more or less to that officer for work.

4,104. The amount of supervision exercised over the construction of Public Works Department buildings by subordinates was not excessive, and a good Executive Engineer regulated his supervision according to the capabilities of the contractor. If a good contractor employed one or two of his subordinates on the construction of a building and they were efficient, the services of a corresponding number of Public Works De-

partment subordinates would not be needed. There was nothing in the working of the Department which prevented the expansion of private enterprise in the building trades, but there were, however, no large European contracting firms in the province.

4,105. When he was Chief Engineer, a certain amount of sanitary work had been constructed by a firm of supervising engineers, but they had not proved satisfactory in that a number of their designs were defective. The firm had in some instances altered their designs in the light of criticism by the Chief and Sanitary Engineers and had in one instance, particularly, incurred a great deal of expenditure in this connection.

4,106. He was opposed to making each branch of the Department self-contained; there were a number of sanitary, electrical and water-works in progress and, if it was the intention to make the best of the young Indian, such works afforded the opportunity of training them under the respective specialists now employed. In his opinion each branch should be placed under the control of the Chief Engineer and transfers between branches should be made permissible so that the branch for which an officer was most fitted would soon become apparent. If an officer showed a preference for example for sanitary work, he should be placed on such work, but this should not preclude him from undertaking ordinary buildings and roads work, so that if sanitary works were shut down he could be transferred to a division.

4,107. Sanitary Engineers should not be recruited from Europe as they did not prove satisfactory until they had had two or three years' experience of Indian conditions and had acquired a knowledge of the language. Such men at present came out to India on a five years' covenant and inconvenience had been experienced in grading them with other officers of the Department particularly on the completion of their first period of service. He therefore recommended that civil engineers should be recruited from England and trained as specialists in India in preference to the present system under which trained specialists were recruited direct from England.

4,108. The Public Works Department should take over municipal sanitary works and increase their cadre so as to be able to supply or lend the services of their engineers to such bodies. This system would eventually prove satisfactory, but it would take some time to train the required number of men. It was true that it would be a retrograde step in local self-government to deprive municipalities of their sanitary works and staff, but such a measure was justified because of the trouble which had been experienced in the province in connection with municipal engineers.

4,109. He recommended that the Roorkee College should be thrown open to the whole of India, as it was desirable to obtain fully trained Indians in India and the college would not prove a success unless it was made imperial. A good many statutory natives of India had

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entered the college when it had been an imperial one, but such was not now the case owing to its being a provincial college. If the college were again made imperial a better stamp of men would be attracted because the service which they would enter would be imperial, and the college would come under the imperial budget on the lines of the forests, post offices and telegraphs. Students could not at present enter the imperial service from Roorkee, and this was precisely what he desired to reintroduce. His reason for so distinguishing the college was because it was the oldest in India.

4.110. The age-limit for admission to the college should be reduced from 21 to 19 years. Students would then be on more of an equality as regards their educational attainments. The age-limit at present was too wide, as men who had passed the B.A. and B.Sc. entered the college. They had thus read physics and chemistry and therefore had an advantage over the men not so educationally qualified. The professors, moreover, were of opinion that it was difficult to give a lecture to men who had previously heard what was being said. If the age-limit for admission were fixed at 19 years, a stiff general examination for entrance to the college should be held to ensure that the general educational qualifications of the candidates were up to a certain standard. No advantage would accrue by affiliating the college to the University. On the contrary there would then be an opening for considerable interference. The college was capable of managing its own affairs, and would become much more attractive in the event of its being made an imperial one. A further objection to affiliation would be the lowering of the age-limit.

4.111. The staff of the college should be a mixed one. The college had hitherto been deficient in its civil engineering staff, but it was now difficult to obtain officers with engineering and educational experience. One such officer was at present employed in the college, but another professor was required and he should be recruited either from the Public Works Department or from England. Some Executive Engineers would certainly object to the latter course, if they had an inclination for the work. The present professor of civil engineering was the only member of the Public Works Department who was on the superior teaching staff. He was an officer of the Irrigation Branch of about 10 years' service and was keen on his work. The subordinate who delivered lectures in connection with civil engineering was really not competent to do so, and a man with better qualifications was required. The only member of the Public Works Department in the assistants' staff was a military upper subordinate.

4.112. The Roorkee College was at present satisfactorily managed by a committee which consisted of the Chief Engineer, the Director of Public Instruction, the Director of Industries, the Principal of the College, Doctor Ziauddin and the Honourable Doctor Sunder Lal. There had been another gentleman on the committee who had, however, recently died, and he was not aware of the name of the gentleman who had taken his place. The management of the college was under the Industries Department, but in his opinion it should be placed under the control of the Public Works Department. He was not aware why the management of the college had been transferred from the Public Works Department, but when such transfer took place it was supposed to have been placed under the jurisdiction of the Education Department. It had, however, been placed under the Secretary of the Industries Department for reasons unknown to him.

4.113. (Mr. Cobb.) The country was in need of highly trained engineers as there were a number of hydro-electric and canal schemes, etc., awaiting development and there was not sufficient staff available for their supervision. There was, therefore, a large opening in India for the highly trained engineer.

4.114. He desired to abolish the lower subordinates' class in the college because it was not a sound principle to have such men trained with engineers. The latter were, however, kept separate from the former at present. About 20 civil engineering students passed out

of the college yearly, and if the lower subordinates' class was abolished room for more civil engineering students would be available, but not to any very great extent as the increase would lead to an increase in expenditure in connection with laboratory and other arrangements. Hence no great advantage would be gained unless a larger number of students were admitted. The hostel in which the lower subordinates were at present housed would be available for the accommodation of civil engineers, and about 30 additional students could be turned out yearly by the abolition of the lower subordinates' class. There was certainly a demand for such a number.

4.115. If Executive Engineers were more efficient, many schemes which were at present scrapped would go through and thus save time and reduce the labours of the higher officers. He himself had suffered in this connection when ill-considered schemes had been submitted for his approval. His remark did not apply only to Executive Engineers of the Public Works Department but also to officers of other departments. There was no doubt, however, that several Executive Engineers of the Public Works Department were inefficient and that most of their projects had to be recast. A great deal of such inefficiency was, however, traceable to the provincial engineer whom he thought ought never to have been in his present position which was chiefly the result of promotion, of seniority. Two standards of efficiency were in vogue at present; the old standard of the Executive Engineer and that of the provincial engineer which was of a lower order, and he had when Chief Engineer frequently experienced difficulty in promoting provincial Assistant Engineers to executive rank in that no definite standard of efficiency was laid down. Had he based promotion on the old standard of efficiency, the provincial Assistant Engineer could not have been promoted. In order to promote him it had been necessary to take a standard of efficiency far lower than which had previously been considered necessary. A great deal of this difficulty would be reduced if the provincial service were abolished. The inconvenience in connection with promotion was entirely due to the introduction of a double standard of efficiency.

4.116. (Rai Bahadur Ganga Ram.) His recommendation that the Roorkee College should be open to all did not imply the abolition of the Sibpur and Poona Colleges.

4.117. One of the effects of lowering the age-limit for admission to the college would be to debar B.As., and B.Scs., but as a matter of fact, students could undergo a B.Sc. training in the college. A stiff entrance examination would be introduced with the object of obtaining and training men when young. The opportunity would thus present itself of seeing whether a man, after serving two or three years in the college, would really make a good engineer and of his leaving college when he was comparatively young.

4.118. He had had experience of men who had entered the college after they had passed the intermediate examination. Such men had of course to pass the college entrance examination, but they were handicapped as compared with the B.A. and B.Sc. students since they received lectures they had never heard before. Hence if the age-limit were lowered, all students would start more on an equality.

4.119. He advocated the encouragement of the system of sending Indian engineers to England after 10 years' service in order to specialize in particular branches of work as he considered government would be well repaid thereby.

4.120. (Mr. Mackenzie.) The primary aim of the college was to supply engineers to the Public Works Department, and men who did not succeed in obtaining guaranteed appointments had to shift for themselves in obtaining private appointments. The college was founded at the time the construction of the Ganges Canal was commenced. The training it afforded was high enough for the engineering needs of the country, but the educationalists in the college were of opinion that too much time was devoted to departmental accounts and estimates. This, however, was a matter which could be rectified by an alteration of the syllabus and this in its turn was a question for the Board of Studies to deal with. The

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[Continued.]

classes on the whole were good, but in some instances studies overlapped a great deal. For example the syllabus for water-works overlapped with that for hydraulics, but the difficulty could be overcome as only a little differentiation was required. It would be a great mistake to shorten the time spent on surveying. Some of the educationalists in the college had objected to the amount of time spent by students on surveying and were of opinion that such could be given at the time of practical training, but in his opinion students would in that event never get the opportunity.

4,121. In his opinion, it would not be worth while to recruit quantity surveyors from England in order to teach estimating in the college. He did not agree with the view of educationalists that drawing was of no value, as he considered it was essential for engineering. Sufficient attention had not as a matter of fact, been paid to this subject, as a number of men on leaving the college actually did not know designing; they could certainly draw, but they had not received sufficient instruction in designing.

4,122. The college course should be of four years' duration. In addition one year, preferably two, should be spent by the students on practical training, and each batch of passed students should be placed under experienced Executive Engineers who should be paid extra for their trouble in this connection, otherwise they would not perhaps devote sufficient attention to the students. Students should not be placed under Superintending Engineers for practical training as such officers generally toured during the cold weather. He was not prepared to recommend, without due consideration, that all the 20 students turned out by the college yearly should be paid when undergoing practical training, but Apprentice Engineers should certainly be paid. Some of the students received very good tuition under private firms, and such firms should compensate them for their services. Diplomas should only be granted to students after they had completed their one or two years' practical training, and it would certainly be an attraction to such men if they were given a living wage during the period of practical training.

4,123. (Rai Bahadur Gunga Ram.) He would personally rather see the college revert to the Public Works Department, but the point was a controversial one. The

college was to a certain extent under the Director of Public Instruction in that all government orders regarding education were received from that officer.

4,124. (Mr. Willmott.) There was no serious objection to the proposal that the Superintending Engineer's office should be greatly reduced and merged into that of the Chief Engineer, the Superintending Engineer becoming a personal assistant to the Chief Engineer and having only a camp clerk.

4,125. He agreed in principle to the proposal that all major designs should be prepared in rotation by qualified men in a central designing office which would act, whenever necessary, in collaboration with the Consulting Architect. He had as a matter of fact, when Chief Engineer, made an effort to create a technical section and as a result the office of the Sanitary Engineer had been located at Allahabad.

4,126. He had seen a great deal of the work of a certain drainage firm in the province. It could not be termed a competent designing firm, and he was not aware of any other designing firm in the province. A good many of the projects designed by the firm in question had had eventually to be recast, and even then in one or two instances they were not perhaps as good as they would have been had they been prepared in the first instance by the Sanitary Engineer. The firm did not make any extra charge for recasting their projects, but it cost them a good deal more in the long run because they had to keep on their staff for a longer period than they anticipated. When the projects had been completed, however, they were good, but not as good as was desired. The method of payment for these projects was that of a percentage based on their gross value. On one occasion the firm had submitted a large project amounting to Rs. 3 lakhs for latrines in a city, but they had previously been told that they should first fix the positions of the latrines in collaboration with the municipality and not include in the project anything more than was required by the municipality. They did not do so, however, with the result that the project was abandoned.

4,127. Four lectures were given in the college on architecture and a certain amount of architectural instruction was also imparted, but the course was only a small one.

W. PARRY, Esq., M.L.C., Municipal Engineer, Cawnpore.

Written Statement.

4,128. I am of opinion that the sanitary schemes of the towns should be prepared by special Sanitary Engineers of the Public Works Department and the construction of the works carried out by the municipal engineer. The Sanitary Engineers should be selected men who have had the necessary training in water and sewerage works in England.

4,129. Schemes for sanitary engineering works should be prepared by engineers with special training in water-works and sewerage and drainage works and not by officers selected from the Buildings and Roads or Irrigation Branch of the Public Works Department who have had no training or practical experience in Sanitary Engineering works.

4,130. As regards municipal engineers, I am of opinion that they should carry out the construction of all works within the municipality, and I think a good deal of the work of district engineers of the Public Works Department could then be reduced by the appointment of municipal engineers for all the large towns as is done in England. The municipal engineers should carry out the construction of the sanitary schemes as they are well acquainted with the details required and can deal better with matters connected with buildings, encroachments and house connections.

4,131. The appointment of a municipal engineer should be made from selection from the Assistant Sanitary Engineers of the Public Works Department after they have had experience in the preparation of sanitary schemes and who have been for at least three years Assistant Engineers

to the municipal engineers of large towns in India, gaining experience in municipal engineering such as roads, buildings, water and sewerage works, buildings applications, the preparation of plans and supervising the connection of private houses and factories with the sewers and water mains and the numerous details connected with a municipal engineer's office.

4,132. As regards contracts, I am of opinion that for the usual yearly municipal repairs and extensions of the water and sewerage works and roads and buildings, the works should be given out to contractors with practical experience and men with capital. Contracts should be made for one year for all estimates up to Rs. 5,000 to two firms of contractors; one contract for the water and sewerage works and another for roads and buildings. The trouble at present experienced in municipal contracts is that invariably the lowest tender is accepted and the rates tendered are impossible for good sound work to be done. Illiterate men with no experience or capital, and who have to buy their materials from the brick and lime manufacturers, tender for works which they do not understand and whose rates are too low to work to or to enable them to engage qualified supervisors to carry out the work.

4,133. As regards the construction of large water-works and sewerage and drainage schemes only master contractors should be engaged, who engage men with practical experience to carry out large contracts and who possess knowledge of sanitary engineering.

4,134. If contracts are given out in the way I suggest I think better work would be done and sound contracting

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[Continued.]

firms would be encouraged to take up the contracts for municipal works, but at present no firms of good

standing can compete against the class of contractors who are at present given contracts.

Mr. W. PARRY called and examined.

4,135. (President.) The witness stated that he was the Municipal Engineer, Cawnpore, and that he had held that appointment for nearly 20 years. He had previously been employed by the Calcutta Municipality on the water-works of that city and as Resident Engineer for the Allahabad and Howrah Municipalities; before coming out to India he had worked with a civil engineer in Liverpool, who had charge of sewerage works, water-works and railways.

4,136. He was of opinion that the designs for all sanitary projects for towns in India should be prepared by special Sanitary Engineers of the Public Works Department in view of the fact that municipal engineers had not the time to undertake large schemes, and as designs for large projects took probably a year or two to prepare. In regard to the suggestion that this work might be given to private firms he remarked that he did not know of any firms in India which were capable of undertaking such work. India, he added, was not like England in so far as the private practice of consulting sanitary engineers was concerned. Such engineers in England had prospects to look forward to and were able to keep up their offices probably for generations, and they only came out to India when they saw no prospect of obtaining work in England. On the other hand, officers recruited for the Sanitary Department were brought out on graded salaries and had prospects of earning pensions. Hence government secured fully competent officers. Further, the money spent on municipal works was really government money, and consequently, he thought, it ought to be looked after by government servants. He admitted that this contention amounted to a desire that government should entertain a Sanitary Branch for the designing of projects, because sanitary engineering in India had not advanced to a stage at which designs might be entrusted to private firms, and suggested that it would be advantageous to recruit experienced men from England for sanitary appointments with this in view. The Cawnpore water-works were designed by the Sanitary Engineer to Government, and the construction was carried out by a private firm of contractors from Calcutta under the supervision of the municipal engineer. He had not had experience of the drainage schemes that had been executed by certain private firms in the United Provinces, nor had he previously been made aware of them.

4,137. Specialists who had been trained in water-works and sewerage works, preferably in England, ought to be recruited for the appointments of Sanitary Engineer to Government. He disapproved of recruitment to these posts of officers from the Buildings and Roads Branch of the Public Works Department because such officers had not the necessary experience, nor had they received the requisite training. Further, in view of the possibility that, if Sanitary Engineers were appointed in India, it would subsequently be found advisable to send them to England for a few years in order to undergo a specialist course of training and gain experience of the latest sanitary developments, he thought it preferable that such officers should be recruited from England in the first instance. Expert qualifications were in his opinion the first consideration that should be taken into account in granting appointments, and he did not agree with the contention that it was more advantageous to recruit officers with a good knowledge of engineering even though they had defective sanitary attainments.

4,138. After the design for a project for a particular town had been prepared by the Sanitary Engineer to Government, construction work ought ordinarily to be undertaken by the municipal engineer in that town. This officer might be a Sanitary Engineer also who had risen from the Assistant Engineer grade. The Government Sanitary Engineer, however, ought occasionally to inspect the work as was at present the practice of this

officer, and might be given power to bring to notice any defects he noticed. The witness admitted, however, that his scheme could only be worked in the larger towns of the province, where qualified engineering staffs were employed, and that it could not be extended to the large number of towns where the municipal engineer was but a subordinate who had received only a very elementary training.

4,139. The construction of large water-works, sewerage and drainage schemes might be made over to master contractors, and in carrying this proposal into effect entire contracts for such works might ordinarily be given to single firms that had had experience in the particular class of work concerned. He modified this statement, however, to the extent that he admitted that it might be necessary occasionally to separate contracts; for instance, a contract for the supply of engines might be given out separately from that for pipes and the masonry part of a work. He considered however, that entire contracts for large works should as far as possible be given to single firms of contractors.

4,140. He had given the whole of a contract for certain sewerage works worth Rs. 6 lakhs to a single firm in Cawnpore. This contract had not, however, been given out as a lump sum contract but by rates. He did not approve of lump sum contracts for water-works or sewerage works, since it was not in his opinion possible, in the case of such works, to enter into such a contract, as payments were made on the weight and lengths of pipes. For instance, if 10 inch pipes were designed and substituted by 18 inch pipes in sewer work, it was necessary to give the contract out by rates in order to measure up the work executed subsequently.

4,141. The contracts of ordinary municipal works might be given out yearly and divided between two separate contractors; one for petty building works and the other for sewerage and drainage works, as such a practice would save continuous invitations for tenders. He remarked that when tenders were invited for such works, contractors who had not been previously employed got to know the rates and, by tendering at rates which were one or two annas less, endeavoured to supplant those who had previously received contracts. Hence he did not think the calling for tenders 'or all petty contracts suitable to this country for maintenance and repair work in municipalities.

4,142. The rates tendered by petty contractors were in his opinion too low to ensure the execution of good work. This he believed was due to the fact that such contractors were men of no status and with no knowledge of the work they desired to undertake.

4,143. He had not made a comparison of the rates at which the Cawnpore Municipality carried out work with those at which the Public Works Department worked in Cawnpore but thought that the two were about the same, since the municipal staff in that city occasionally consulted the Public Works Department officers there in regard to rates.

4,144. There was also not much difference between the rates at which private enterprise carried out work in Cawnpore and those of the Public Works Department or municipality. He remarked, however, that since privately erected buildings were not supervised it was quite possible for a private firm, by not paying attention to the materials used, to construct buildings at cheaper rates. A large number of mills were continually under erection by a firm of contractors in Cawnpore. These structures were generally erected at uniform rates, which, however, were not less than the prevalent rates of his municipality. On the contrary, the rates were about the same.

4,145. The amount of supervision at present exercised over large firms during construction could not, in his opinion, be materially reduced if well executed work

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[Continued.]

was desired. Such firms did not pay their assistants the same rates of pay that Public Works Department officers received and their assistants besides were not experienced engineers. He did not agree with the contention that if large firms of reliable contractors were employed it might be possible to do without a large proportion of the subordinate staff of the Public Works Department as the firm could be trusted to work satisfactorily with only such inspections as might be considered desirable by superior officers, as the private contractor, or the contracting firm which took up a contract, was generally in the hands of petty contractors who carried out work on their own behalf, unless the work was properly supervised, especially as petty contractors measured up work every day and as their measurements were very seldom checked by the large firm when making payment. From his experience he concluded that large contracting firms very frequently sub-let parts of their contracts.

4,146. (Sir Noel Kershaw.) He confirmed the contention in his written statement that the difficulty in regard to municipal works lay in the fact that the lowest tender was invariably accepted. Though the practice of his municipality was to ask him to recommend a particular contractor, the municipal committee did not always agree to his recommendations. He recently had difficulty with his committee in connection with a "lowest tender" that had been submitted by a contractor who was not capable of carrying out sound work. He had recommended the next tender, which was that of a certain European firm and which was 2 or 3 per cent. higher, and after a delay his committee eventually agreed to accept his nominee. He remarked that the Board often tried to accept the lowest tender even when he had reported strongly against the tenderer, but that ultimately and generally they lost their case. The tender system had however worked satisfactorily in spite of considerable canvassing amongst members in respect to elections.

4,147. (Mr. MacLenzie.) In explanation of his preference for rate contracts over lump sum contracts, he remarked that lump sum contracts for sanitary and water-works were difficult to make because schemes were frequently altered and payments were made on the weight and lengths of pipe generally as shown by measurements of different diameters. He thought the adoption

of the lump sum contract system would lead to loss of money, and that the system was also disadvantageous for building works.

4,148. (Rai Bahadur Ganga Ram.) An Executive Engineer who was not himself a specialist in sanitary engineering would not be in a position to criticise a scheme prepared by a specialist in that branch. If schemes were prepared by private consulting engineers and were found defective in some respects, perhaps three years later, it would be difficult to fix responsibility, whereas it would be possible to hold government officers responsible in such cases if his suggestions were given effect to.

4,149. His remark regarding the sub-letting of contracts by private firms of contractors referred to the practice such firms had of sub-letting to *mistris* different portions of their work.

4,150. (Mr. Cobb.) His own municipality was not averse to their sanitary schemes being prepared by Sanitary Engineers of the Public Works Department. Although this body usually requested him to criticise or scrutinise sanitary schemes, they were aware that he was generally largely occupied with his own work and had not the leisure for the preparation of large schemes. He thought his municipality paid a percentage of 12 per cent. for the preparation of schemes on their behalf.

4,151. (Mr. Willmott.) If officers were recruited as general engineers for three years and during that period were given a training in sanitary engineering, and were then sent to England for a two years' course in order to specialise in that branch, he did not think they would prove as satisfactory as men who had specialised before coming out to India.

4,152. The municipality of Cawnpore had agreed to the proposal that municipal engineers might be brought on to the same cadre as government engineers and he did not think other municipal boards would object. Under this arrangement municipal engineers would be absolutely subordinate to their respective boards, but would be appointed at the recommendation of government subject to the approval of the boards. He admitted that his municipality had agreed to forego their power of patronage over their municipal engineer and had reserved only the right to remove that officer whenever they had good cause for deciding to take this step.

At Allahabad, Tuesday, 3rd April 1917.

PRESENT:

F. G. STY, Esq., C.S.I. I.C.S. (President.)

SIR NOEL KERSHAW, K.C.P.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

C. S. COBB, Esq., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

THE HON'BLE MR. H. M. WILLMOTT, F.C.S.I., A.M.L.C.P., (Chief Engineer and Secretary to the Government of the United Provinces, Public Works Department, Buildings and Roads Branch.)

D. G. HARRIS, Esq. (Secretary).

J. H. ABBOTT, Esq., PARTNER, MESSRS. ABBOTT BROS., JHANSI.

Written Statement.

4,153. (I.) Economy and suitability of methods of execution of public works, and (II.) Encouragement of other agency.—Our experience of 35 years as successful contractors is that in the great majority of cases the officials of the Department do not encourage big and well established contractors but encourage rather a system of petty contractors, thus dividing the work in a district

(for example) into a series of petty and scattered contracts each provided over by its individual contractor whose sole aim and object, practically without exception, is to make as much as he can out of the contract, irrespective of the quality and nature of the work concerned. So much for the contract system. Turning to the Department itself. They cannot afford to give the work out to a firm of big contractors who have a reputation to main-

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tain and the quality of whose work is far superior to that of the petty contractor. They therefore employ the latter class, added to which it is regrettable to state that you will invariably find an inexperienced and Apprentice Engineer in charge of an important section or of an important work. The combined result is chaos. The position is anomalous. Take for instance a comparative example in a business firm. You never find a large business house placing an inexperienced man fresh from England in charge of an important department. If they did in 90 per cent. of cases the result is a foregone conclusion. They adopt a procedure of giving that man a term of practical training under Indian conditions. I would suggest the same expedient in respect to the Department. I do not bring into question the engineer's theory of engineering but only his want of practical knowledge of Indian conditions.

(2). To remedy these deficiencies in a department which is so necessary for public welfare we would suggest that one contractor or one firm of contractors with a reputation and financial status should be given all contracts in a district for a certain term of years—say ten years. The contractor appointed will be liable to keep an engineering staff and drawing office, submitting all estimates, specifications and drawings for approval and sanction

to the Superintending Engineer in charge of the division who will periodically inspect the works in progress.

(3). The projects, specifications, drawings, estimates, etc., of all large major works will be drawn up by the Superintending Engineer personally.

(4). The contractor will be solely responsible for the quality of work done and in the event of any damage, which on examination is found to be due to inferior work, below the standard of the specifications, the contractor will bear the loss and be liable to a heavy fine in way of compensation.

(5). This method will not only centralize the work into one body and under one central control but also be most advantageous to the government concerned in so much that it will do away with Executive and Assistant Engineers and the subordinate staff entirely, save the erection of houses, house rent, etc., etc., and procure a higher standard of work. The Superintending Engineer will be a man of experience transferred from the cadre of another engineering department.

(6). Our firm opinion is that a first-class contractor can do work very much cheaper and of a better quality than government can get done departmentally and they can defy competition.

Mr. J. H. ANNOTT called and examined.

4,154. (President.) The witness stated that he was a contractor of 37 years' experience. His firm undertook large irrigation works and the construction of dams and small road bridges in connection therewith, but practically no buildings and roads work.

4,155. The firm engaged no engineering staff, but employed young men for supervisory purposes who joined the firm at about 18 years of age and picked up their knowledge of engineering by actual experience on works. These men generally became specialists in the particular line in which they were employed during their period of apprenticeship and were thus quite suitable for supervisory purposes.

4,156. In his opinion the Public Works Department did not encourage large contractors as they generally dealt with petty contractors, and gave out a large number of contracts in a district to several contractors instead of to one. The Department usually invited piece-meal tenders for irrigation works. He advocated that all petty works in a district should be lumped together and given to one contractor.

4,157. Such a system would not be difficult to work out. He had a few years previously induced a municipality to start it and to frame their rates for different works, i.e., roads, buildings, or any other work that was likely to arise during the financial year and then to call for tenders for the supply of materials and for consolidation for a period of three years. He would in this case have preferred to have one contractor for the whole work, but as the system was being given its first trial separate tenders were invited for all petty buildings below Rs. 100. The system he therefore proposed was that a contract should be given on a schedule of rates for a period of ten years and that all work executed during its currency should be paid for according to the rates in that schedule.

4,158. This system was to a certain extent open to the objection that it would create a monopoly in favour of one firm for a considerable number of years, but as contracts would be open to competition it would secure the best men available. Besides, as there were a large number of districts, the majority of the good contractors would be given work at the start and this would practically result in each contractor being given the contract for one district. The system, in addition, would encourage private enterprise by providing employment for a large number of contractors. Under the existing system petty contractors with no finances were engaged and their sole object was simply to complete their work and make as much money as they could

without paying any attention to the quality of their work, whereas they would be employed by large contractors under the system he proposed. If a particular firm established say at Lucknow were precluded from doing work in the Lucknow district for ten years owing to the contract having been given to another contractor, it could tender for works in another district or take up railway, irrigation or private works, as it was not essential that it should obtain government works only. There was great scope in India for contractors and a really good firm would never be without work.

4,159. The system he proposed would not crush the small contracting firms as petty contractors would work under large contractors and would be eligible for being entrusted with larger works as they obtained sufficient experience and were fit for a higher class of work. There were many instances in the Irrigation Department of large contractors employing petty contractors who eventually developed into large contractors themselves, and large contractors would be willing to help the small ones. As an example he stated that some men of this class who had been employed and trained by his firm had since taken up large contracts. This occurrence in fact was one that happened frequently in all business firms and on many occasions men who had joined firms had started their own businesses after they had acquired sufficient experience. He added that there would be ample scope for petty contractors who themselves preferred to work under large contractors.

4,160. The firms which should be entrusted with the work should be firms of reputation. The Chief Engineer of the province would have no difficulty in ascertaining which firms were good from the Superintending Engineers who in turn would obtain the information from the district civil officers. Firms which were not put on the approved list would, no doubt, have a grievance but in case a firm had any complaint against the Chief Engineer it might have a right of appeal to the Secretary to Government. If the work of any firm on the approved list subsequently deteriorated it could be struck off the list. This was the practice followed in the Supply and Transport Department where a man had to apply to be brought on to the register. Inquiries were then made of the civil authorities and from other sources and in the event of these proving satisfactory the applicant was brought on to the list, all work being given only to men on such list.

4,161. Large contracting firms should also be allowed to prepare estimates not in excess of Rs. 10,000 for the works they constructed. It was true that under such

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a procedure there would be a tendency to run up estimates, but this could be checked by the examination of estimates by the Superintending Engineer. Estimates for all works in excess of Rs. 10,000 should however be prepared by the Superintending Engineer.

4,162. No supervision should be exercised over contractors except by the Superintending Engineer. He did not agree that proper work could not be carried out without supervision and cited a case in which he was entrusted with the supply of fodder at the time of the Delhi Durbar of 1902. The Commissariat-General interviewed him in this connection and told him that he was aware of all the worry and trouble contractors were put to by subordinates and that he desired to give him the contract without any supervision by the Department. All he was required to do was to despatch the fodder for distribution to Delhi on his own responsibility and to put a label inside each pressed bale so that, if rejected, bales might be returned to him, he receiving no payment for such bales and paying the railway freight to Delhi which was 10 per cent. less than the ordinary rates. This experiment had worked satisfactorily and he suggested that on the analogy of this case contractors should not be paid for the work which was found to be faulty on inspection by Superintending Engineers, and that in addition such officers should in the case of large works pay surprise visits and in cases of doubt have even the foundations dug up to see that they were sound. Such system had been followed on the Indian Midland Railway new section of the Great Indian Peninsula Railway some years previously and one of the government inspectors at the time had told him that he had on several occasions dug up foundations to see that they were all right. Hence the same procedure could be adopted in the Buildings Branch of the Public Works Department. If a foundation, however, was washed away by flood and it was found that it was due to faulty work of the contractor the onus would rest with him, whereas under the present system a contractor in such a case went away with his profits as he was not held responsible after his work had been passed by an engineer of the Department. Under the system he had advocated, on the other hand, a contractor would have his reputation and a large amount of money at stake and in the event of a bridge being washed away due to bad work would be held responsible. Apart from this, honest contractors could be found as easily as honest engineers on whom government depended for the execution of all their departmental work. In the case of the former the necessity for honesty would be all the greater as an engineer who got into trouble might be pardoned and obtain a post somewhere else, but a contractor who was once placed on the black list would be ruined for ever.

4,163. His reasons for recommending that no supervision should be exercised over contractors except by the Superintending Engineer were principally financial as it would lead to a great saving on establishment and the provision of office and residential accommodation. Apart from this a large number of the subordinates who were employed to supervise works harassed contractors and did not do much good, as they were always ready to submit bad reports on the work of contractors thinking that if they did not do so the Executive Engineer would consider that they were doing no work at all. As an instance, he cited the case of a senior engineer who, when asked what subordinate staff he would require in connection with the construction of a large dam, had replied that the less the subordinate staff the quicker would the work be done. In these circumstances, he was in favour of a system under which contractors would employ their own staff for the construction and supervision of work subject to the supervision of the Superintending Engineer only, such system to apply even in the case of works scattered over districts. The proposal would not necessitate any increase in the number of Superintending Engineers as such officers would be relieved of a great deal of their present office work.

4,164. One of the reasons why good and self-respecting contractors were not available was that they were treated

in the majority of cases merely as suppliers of labour and materials. Another drawback was that experienced contractors had to work under young men fresh from England with no practical experience who would not allow them to work in the manner best suited to Indian conditions, but would insist on their adhering to English methods. Contractors were accordingly allowed no freedom and had to submit to the whims of young officers to the detriment of their work. His personal experience on irrigation works had been that such difficulties were frequent, and that contractors had sometimes to spend four times the amount which would have been required had they been allowed to follow the methods dictated by their own experience of work in the country. In his opinion, therefore, engineers who in particular kinds of work had not had at least 12 months' experience in India should on no account be placed in charge of large works. It should also be laid down as a standing rule that before a sub-divisional officer was placed in independent charge of a division he should have had practical experience on large works. His complaint had particular reference to the Central Provinces, where young officers with no experience were generally placed in charge of large works, and not to the United Provinces.

4,165. By the remark in his written statement that the Department could not afford to give out work to a firm of big contractors who had a reputation to maintain, he meant that the estimates for a large number of works were so reduced that they did not admit of first-class work being done by first-class men and that this in its turn resulted in much work being done departmentally. The Department did not get first-class work done at the same cost and he was of opinion that departmental work was much inferior since it was executed by an inferior agency. The Public Works Department rates were not sufficiently liberal to allow of the work being carried out to specification by large firms, and when work was executed departmentally specifications were not abided by. He believed some engineers had stated that no contractors could carry out work as cheaply as was done by departmental agency, but he would reverse that assertion and say that no departmental agency could possibly work as cheaply as a large local contractor. The reasons for this were threefold. Firstly, because the engineer in charge had not as much local experience as a well established firm; secondly, because such an officer had no control over labour and did not possess as good means of securing labour as a contractor; and thirdly, because government did not grant advances as was the practice with contracting firms, which sometimes granted them five to ten years in advance of a contract. Government might grant special advances on special occasions, but could not afford to make them on as large and systematic a scale as contractors who could thus command the best labour that was available, while the Public Works Department officer had to make his own arrangements in this respect and was in the hands of the local people.

4,166. Petty contractors had no advantage over large contractors in securing labour as they had to pay interest on the money they borrowed and were not therefore able to grant sufficient advances. Their local knowledge also was not of much help to them on account of their lack of funds.

4,167. He had seen several instances in which engineers adhered strictly to specifications when getting work done by contractors, and paid no heed to them when executing work departmentally. He here cited a case in which a contractor who was engaged on the construction of an earthen dam was required by the engineer in charge to adhere strictly to a specification, with the result that the contractor was altogether ruined. He was then asked to take up the work, but told the engineer that the specification could not be rigidly followed. The work was eventually taken up departmentally and the specification was entirely discarded.

4,168. If the departmental system were cheaper, a railway company such as the Great Indian Peninsula Railway which possessed good engineers who were not

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ried down by any rules or regulations in the matter would not get their works done by contractors. He added that the Maharaja of Gwalior, who was a very enlightened ruler, also got his work done by contractors and that he would not have adopted this method if he could get work done cheaper by the departmental system. It was true that the Maharaja employed both large and small contractors and that his works were not carried out without supervision, but he had instanced this case only to indicate the weakness of the suggestion to do away with contractors by resort to the departmental system. The Maharaja had adopted the contract method in preference to the departmental system and had found the former very much superior and cheaper.

4,169. (*Sir Noel Kershaw*.) He believed that the system of getting works done with the supervision only of one officer was in force in Bombay and Calcutta in cases in which large works were carried out under the supervision only of the Architect who had designed the buildings. In his opinion most of the scattered works in districts were minor ones and no supervision was required for them if a conscientious contractor were engaged. Hence the Superintending Engineer would not have much travelling in the districts. He was not aware, however, of any firm which carried out work on this system in as large an area as that of a Superintending Engineer's circle.

4,170. It was quite possible for the present staff of Superintending Engineers to supervise scattered works in the districts, as these officers would not have much more supervision work than at present and there would be no need for their touring the districts more frequently. It was true that under such conditions it might so happen that some of the works which would be completed in short periods might never be inspected by a Superintending Engineer, but the contractor if, he were engaged for a period of ten years as he had proposed, would realize his responsibility and feel that if he did inferior work at any time he would lose his reputation and be a ruined man. He did not agree with the view that such contractors would at the end of their term of ten years be liable to temptation to do bad work owing to there being no hold over them at the expiry of that period and contended that the same argument could be applied to sub-divisional officers towards the close of their service, as he had known of several subordinates who retired with big fortunes.

4,171. When he was chairman of the public works committee of the Jhansi Municipality 12 years previously he had lumped together small works relating to roads and buildings and given the whole as a single contract to one large contractor, and had found by an actual comparison of the rates that the cost of execution was cheaper than the cost of execution by the Public Works Department, and that the quality of the work also was better. This system had however been abandoned on his relinquishment of office not because it was considered to be a bad one, but because of a petty complaint that the man who had been given the contract was favoured. The witness had carefully scrutinised the figures and had found that the new system had not resulted in any additional expenditure in the construction or maintenance of buildings. He had also seen the works periodically and had no cause for complaint. He was therefore strongly in favour of the adoption of the system and stated that he would endeavour to introduce it again if he were the chairman of a public works committee.

4,172. (*Mr. Mackenzie*.) He did not sub-let his contracts in the customary manner, i.e., by sub-letting works at a percentage below the rates accepted by him, as he considered such a system was dangerous. He however got petty contractors to supply stone, *lankar* and other materials. He approved of *lankar* that was to be supplied at the quarry so that there could be no question as to its quality. Continual supervision was exercised by the paid staff of the firm during the burning and mixing of lime.

4,173. Under the system advocated by him all sub-contractors employed by large contractors and the sub-

ordinates employed by them would be approved by the Chief Engineer.

4,174. The contractor's certificate to the effect that he had carried out work properly should, as a rule, be sufficient authority for payment. A policy of trust was essential just as much with contractors as with recruiting agents who performed tours and were paid their travelling expenses on receipt of their bills although their movements could not possibly be checked.

4,175. (*Rai Bahadur Ganga Ram*.) The witness had his firm at Jhansi when he undertook the contract for the supply of fodder at the Delhi Durbar of 1902. The firm undertook practically no building contracts.

4,176. Advances were not given for earth-work but were given to labourers in stone quarries.

4,177. (*Mr. Cobb*.) A reliable contractor would be willing to sign an agreement for the construction of works in a district for a specified period on the condition stated in his written evidence, viz., that he would be solely responsible for the quality of work done and in the event of any damage, which on examination was found to be due to inferior work, below the standard of the specifications, would bear the loss and be liable to a heavy fine by way of compensation; and he himself would be prepared to enter into such an agreement. He had no objection to the suggestion that contractors should have their accounts checked by government to see that they were not getting more than reasonable profits out of the public funds.

4,178. (*Mr. Willmott*.) His suggestion that Superintending Engineers should inspect the work of contractors was made with a view to a reduction of the present establishment, and not because of the insufficient experience of Executive Engineers for supervisory work.

4,179. The period of ten years which he had suggested for the giving of contracts would not necessarily be sufficient for disclosing defects in a structure. He had only suggested that period in order to make his scheme workable, and as a contract could not obviously be given for so long a period as 30 or 40 years. A shorter period than ten years, on the other hand, would be too small.

4,180. It was not necessary to provide for the formal handing over of buildings at the close of a ten years' contract nor for the making of a regular survey of the whole area, as the annual report of the Superintending Engineer would be sufficient for all practical purposes.

4,181. By the remark in his written statement that "the Superintending Engineer will be a man of experience transferred from the cadre of another engineering department" he meant that, as Assistant and Executive Engineers would be abolished under the system he had advocated, Superintending Engineers would be selected from the irrigation or railway engineers who naturally would also have ample knowledge of roads and buildings.

4,182. It was very difficult for a contractor to appeal to an Executive Engineer in cases in which strict adherence to a specification was insisted on.

4,183. (*President*.) Subordinates in the Department were very much underpaid. Sometimes an overseer was put in charge of a work costing Rs. 20 lakhs and it was altogether wrong in principle to entrust him with such responsibility on his small pay. In his opinion men should be paid according to their qualifications and responsibilities. Accordingly a man placed in sub-divisional charge should be paid the higher salary attached to that post. He added that an improvement in the pay of subordinates would lead to an improvement in the class as a whole.

4,184. Executive Engineers should, as in the case of business firms, have summary power of punishing subordinates, even on suspicion, and such officers should also be authorized to suspend a man against whom they had any suspicion at once and to dismiss him subsequently if their suspicions proved correct, giving him a month's pay. The dismissed man should, however, have a right of appeal. In his opinion, subordinates at present defied their Executive Engineers as they were in permanent service and Executive Engineers could only have them transferred.

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[Continued.]

H. LANE BROWN, Esq., M.I.C.E., PARTNER, MESSES. LANE BROWN AND HEWLETT, Consulting Civil and Sanitary Engineers, Lucknow.

Written Statement.

4,185. (Qualifications.) Member, Institution Civil Engineers, England, of some 15 years standing, Associate Member in 1894.

Age 49.

Engaged in Westminster and various works in England as assistant and resident engineer, design and construction of water and sewerage works under engineers of eminence notably Chatterton of Bazolgetto Chatterton and Baldwin Latham. In 1898 selected from six nominations to take charge of the water-works and sewerage of Bonares.

Appointed by government supervising engineer to undertake on fees design and construction of works of sanitation in the United Provinces.

1898-1903

By arrangement with the United Provinces Government permitted to extend practice as a consulting engineer outside those provinces on being engaged by the Government of the United Provinces to provide comprehensive schemes of sanitation for all the cities in the United Provinces. Also engaged for similar works in Central India and elsewhere.

1903-1905

Took into partnership P. R. Hewlett, A.M.I.C.E. and to date have prepared schemes of water-works, drainage and sewerage in Northern India for cities to a value in estimated projects of some Rs. 3,82,23,229 = £3,618,000 and of construction of some Rs. 64,00,000 = £426,000.

1905 to date

Have also been employed by departments of government and privately to design and construct buildings estimated at about Rs. 14 lakhs = £90,000 odd.

4,186. (I.) Economy and suitability of methods of execution of public works.—It presumably will always be necessary for a government department to carry out the actual government works of the country. By actual government works is meant those comparable to works at home which, for sufficient reasons, are carried out directly by government, viz., by Military Works, Admiralty or the Office of Works and to those should be added in India, State Railways and Irrigation. Therefore the answers herein should be taken to apply only to the works (other than any of the above named government works) at present carried out by the Roads and Buildings Branch of the Public Works Department.

(2). It will be a number of years before the works in the hands of the Public Works Department, Buildings and Roads Branch, can be satisfactorily carried out by open agency, and the question appears to be not of any immediate change, but of general policy, that is, is the Public Works Department to continue to undertake these works to the exclusion of private agency as at present and therefore stifle and prevent that agency expanding, or is the policy to be to open these works to private agency when suitable, and thus to foster and encourage the growth of private enterprise and thereby to provide healthy competitive execution of works as in other countries? As matters stand, it can scarcely be supposed that the Public Works Department agency can be as economical as that of private firms, for the following reasons.

(3). The supervision charges are inelastic, and the execution of work by permanent pensionable agency must necessarily be so. If the yearly amount of work in hand be large, the rate of supervision may be low, but when work is diminished supervision charges must be unnecessarily high and the result is that the actual rate of supervision, so far as we can ascertain, costs an average of 19 per cent. with a maximum of over 30 per cent. If the average supervision charges be taken at 19 per cent. not, pension charges must be added to this to get the actual total cost of the Public Works Department supervision. For this we have no figures to put forward.

(4). In a pensionable permanent service recruited in practice from the results of a theoretical examination, it is inevitable that in certain cases the standard of efficiency must be lower than that permissible in a private agency.

(5). The standard of work is good, but there is no reason to suppose that private agency cannot equal this, more especially if the scope of undertaking possible is enlarged sufficiently to allow of the training and employment of suitable staff by private firms, and if complete standing orders and specifications are worked to.

(6). Public Works Department rates are not low as a rule and would form a suitable basis to work to in open market; it would be undesirable to encourage throat-cutting competition to a degree which might militate against a sufficiently good standard of materials and work. It would be better to contemplate full rates with a black-listing of any firms who may endeavour to scamp work in any respect.

(7). In my experience as resident engineer with the Ecclesiastical Commissioners at home, this method afforded a most certain means of ensuring good work and materials. Paying good firms good money for good works is undoubtedly the best method of execution in the long run.

4,187. (II.) Encouragement of other agency.—For the last eight or more years in these provinces the encouragement of private enterprise has been entirely absent, and on the contrary, the policy has been to keep the whole execution of works in the hands of government engineers and to exclude rigorously any private engineering either in design, execution or criticism, examples of exclusion can easily be given, more especially in the matter of the design and execution of works of sanitation, water-works and drainage.

(2). The Educational Department have obtained during the last two years government sanction to the employment of my firm on the design and construction of various high school buildings, and the result has apparently been satisfactory as on the approaching completion of some five high schools we have been entrusted with the design and construction of three more. These schools average in cost rather more than a lakh of rupees each. But it should be noted that these works have been entrusted to us direct by the Educational Department and not as from or through the Public Works Department, although the latter course would have been preferable.

(3). As to the possibility of entrusting certain classes of public works to private agency, we consider that there can be no actual difficulty in so doing. The only necessity would be to provide efficient scrutiny and safeguard by government engineers, but if these engineers are carrying out themselves comparative works it would appear to be almost certain, human nature being what it is, that unnecessary friction would be engendered.

(4). We understand that proposals may be put forward that certain classes of work such as district board and possibly other minor works may be handed over by the Public Works Department to private agency, this concession would, we fear, not go far enough to ensure any measure of success, for inferentially the major, and therefore more remunerative works, would be kept from the private agencies and thus their scope of work would be so restricted as to prevent their employing and training satisfactory staff.

(5). As to the lines on which private agencies could undertake work we have drafted certain suggestions for design and construction of works for the Educational Department under the scrutiny and control of the Public Works Department which might possibly be considered when the question of such undertakings is discussed (See Annexure A).

4,188. (III.) Changes in organization, and (IV.) Relations with other departments and sub-branches.—Such portions of the above inquiries as may be within our knowledge are covered by the answer to inquiry (V) below.

4,189. (V.) Decentralization.—Since arriving in this country in 1898 it has continued to be a source of surprise

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[Continued.]

to me that the safeguards and provisions of the Local Government Board have never apparently been considered by local Governments in India in the matter of inception, design, financing and construction of public works, more especially those of major works of municipalities. On the contrary, in so far from any question of decentralization being considered, the deliberate policy has been, and certainly for the past eight or more years, in these provinces to keep the whole of such works entirely in the hands of the Sanitary Engineer, who has been with very few exceptions recruited direct from the Executive Engineers' grade of Public Works Department engineers without any previous training in the design and execution of such special works. Had no other agency been available, this procedure would have been inevitable, but except in possibly one instance recourse to recruitment of fully trained and experienced Sanitary Engineers from home has not been considered necessary, nor has, in these provinces, any employment of ourselves been considered possible, although a perusal of the list of the sanitary works designed and carried out by my firm in various parts of India (see Annexure B), to say nothing of home experience, would show that our qualifications and experience are such that, in any other country in the world, it is probable that government would have availed themselves of our services and allowed municipal bodies also to do so.

4,190. (VI.) Simplification of procedure.—Have no experience, question apparently departmental.

4,191. (VII.) Education, and (VIII.) Practical training.—It seems to be in this country a fixed idea that the major part of an engineering education can be obtained from a collegiate course finishing with a paper examination and possibly with a short course of what is termed practical training. The education given in Indian engineering colleges seems to us to be fully sufficient for the grounding of an engineer, for many eminent engineers have graduated from these colleges, but we feel strongly that there has been a tendency to consider this theoretical education, whether in India or at home, to be the be-all and end-all of an engineering qualification. Any paper examination must fail to prove whether the young engineer is fit to assume responsible charge of works, for instance, tact, honesty, physical energy and common sense cannot be examined for with a desk, paper and pen. Nothing but actual test can prove these points and we would suggest that the paper examination should be considered as only qualifying for probationership; and a period of not less than three years, but preferably five years, of satisfactory responsible employment should be necessary before the full qualification of an engineer whether recruited at home or in India should be attained. If the student having passed his paper examination be posted as a probationer, it will be in his hands to obtain from his employer, whether government or private, a yearly report as to his usefulness on work and the amount of responsibility it has been possible to place in his charge. In the case of private agency such as ours, in the case of execution of design and construction of public works, it should be possible to lay down the ratio of employment of such probationers per amount of work, and government might fairly consider as a scholarship the payment of the salary of the probationer for say the first 18 months and say half for the next 18 months.

(2). It would be necessary for a scale of pay to be framed for these probationers, based in the first instance on the pay necessary to provide a living. The amount should be sufficient to avoid any possibility of necessity of obtaining means in any doubtful manner.

(3). The report each year should be communicated to the probationer who should be entitled to an appeal to a small independent committee. Any probationer should be subject to suspension by his employer for unsatisfactory work pending the decision of such committee who should have the power to suspend him or to cancel his probationership entirely, on being satisfied as to the correctness of the adverse report.

ANNEXURE A.

Suggested rules for the construction and supervision of buildings for the Educational Department by private agency.

The Director of Public Instruction may enter into agreement with a private agency for the construction and supervision of buildings of which the plans and estimates and specifications have received the Chief Engineer's approval on the following terms, viz:—

The rates having been approved of and the total cost at such rates ascertained, the cost of supervision at fifteen per cent. will be added to make a lump sum for construction and supervision for the building shown and specified in plans and estimates, and the agreement will be for the execution of this work at this cost in a given time. Should the Director of Public Instruction consider in case of delay that this has been by default of the engineers and not from any cause outside their control, a named sum may be deducted at his discretion from the final payments taken at a given deduction per day of such delay.

The work shall be inspected three times during construction by the Superintending Engineer of the circle in which the construction may be situated. The first inspection shall be of the excavation for foundations.

The second of work in progress at a stage when walls are up and roofs being laid in and the third on completion.

The final inspection on completion shall include the examination of the building and the passing of the final accounts, taking into consideration the sub-heads of estimates as against check measurements, and the work, if any, carried out as against contingencies.

The agreement for construction must contain a proviso that the buildings be maintained by the engineers for a term of three years at a percentage of say 1½ per cent. taken on actual completed cost of the buildings (required specification of maintenance usual by P. W. D.)

Suggested rules for the preparation of plans and estimates for buildings for the Educational Department by private agency.

(1). The Director of Public Instruction shall in the first instance specify the class of building required with accommodation required giving the requisite floor and air space considered necessary per student and master.

(2). An agreement will then be entered into for the preparation of plans and estimates on fees taken at 2½ per cent. of the estimated cost.

(3). The private agency will thereupon prepare pencil drawings as follows:—

- (a). Site plan showing position of proposed buildings.
- (b). General plans of all buildings.
- (c). Elevations and cross sections of all buildings.
- (d). Draft specification giving all necessary calculations.

These pencil drawings and specifications will be submitted to the Chief Engineer for scrutiny and approval.

On the plans, etc., as above, receiving approval, detailed quantities shall be prepared and submitted with rates for approval.

On the rates being scrutinised and approved, the drawings, specifications and estimates will be fairied out and be approved by the Chief Engineer and copies deposited with him.

The fair copies of plans, specifications and estimates will then be forwarded to the Director of Public Instruction and fees for preparation paid.

Submission of final plans and estimates.

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[Continued.]

ANNEXURE B.

Sewerage, surface drainage and water-supply schemes, prepared and constructed by Messrs. Lane-Brown & Hurdell, Consulting Civil and Sanitary Engineers, (1898 to 1914).

Serial No.	NAME OF CITY.	Projects prepared to date.	Projects under preparation approximate estimate.	Construction completed.	Construction in hand.	Serial No.	NAME OF CITY.	Projects prepared to date.	Projects under preparation approximate estimate.	Construction completed.	Construction in hand.
		Rs.	Rs.	Rs.	Rs.			Rs.	Rs.	Rs.	Rs.
	SEWERAGE AND SURFACE DRAINAGE SCHEMES.										
	<i>United Provinces :—</i>										
1	Benares City . .	33,00,000	..	16,00,000	..	31	Dacca City . .	24,16,468	..	..	..
2	Lucknow City . .	26,00,000	..	14,00,000	..	32	Hazratnagar City . .	88,450	..	..	..
3	Mirzapur City . .	3,10,000	..	3,10,000	..		<i>Central India :—</i>				
4	Fyzabad City . .	4,00,000	..	96,000	..	33	Indore City . .	26,12,000	..	..	..
5	Jaunpur City . .	1,56,000	..	1,50,000	..	34	Indore Residency . .	2,63,000	..	..	..
6	Allahabad City . .	18,35,880	..	..	..		<i>Bombay :—</i>				
7	Hathras City . .	2,60,000	..	2,05,000	..	35	Kalyan Junction, G. I. P. Railway . .	1,22,257	..	..	..
8	Saharapur City . .	4,35,110	..	..	..		<i>Baluchistan :—</i>				
9	Shahjahanpur City . .	6,57,000	..	..	..	36	Quetta City . .	5,24,180	..	..	..
10	Muttra City . .	5,31,000	..	..	..		<i>Punjab :—</i>				
11	Brindaban City . .	3,01,780	..	..	..	37	Multan Cantonment . .	88,706	..	..	..
12	Bahawalpur City . .	4,15,000	..	..	..		Multan City . .	..	6,00,000	..	..
13	Ghaziपुर City . .	1,35,000	..	..	..	38	Amritsar City . .	2,22,774	..	2,20,000	..
14	Hapur City . .	3,20,611	..	..	..		Lahore City . .	16,15,116	..	..	..
	<i>Central Provinces :—</i>						<i>WATER-WORKS.</i>				
15	Nagpur and Trade-dock Town . .	37,61,000	..	..	16,00,000		<i>United Provinces :—</i>				
16	Jubbulpore City . .	2,201,486	..	..	..	39	Benares water-works extension . .	..	..	1,65,000	..
17	Wardha City . .	2,05,000	..	2,05,000	..	40	Lucknow do. do. . .	..	..	50,000	..
18	Khamgaon City . .	2,70,976	..	..	..		<i>Punjab :—</i>				
19	Akola City . .	1,39,010	..	..	..	41	Delhi water-works extension for Darbar, 1911 . .	..	..	1,25,000	..
20	Burhanpur City . .	1,50,000	..	..	..		<i>N.-W. P. Provinces :—</i>				
21	Khandwa City . .	2,15,000	..	..	..	1	Peshawar drainage and water . .	28,72,251	..	..	..
22	Hards City . .	2,16,461	..	2,00,000	..	42	Abbottabad City water-works . .	1,48,356	..	..	..
23	Parasi City . .	89,131	..	..	..	43	Mansehra do do . .	10,210	..	..	..
24	Bhandara City . .	2,50,000	..	..	..		Bunnos do do . .	3,25,787	..	..	..
25	Raipur City . .	5,10,000	..	..	..		<i>Central India :—</i>				
26	Bilaspur City . .	1,50,000	..	..	..	44	Indore Residency water-supply . .	..	..	1,10,000	..
27	Amroli City . .	6,10,000	..	..	..		<i>GRAND TOTAL Rs.</i>	5,76,23,227	6,00,000	48,15,000	16,00,000
28	Deoni City . .	1,70,000	..	..	..		<i>OF SAYE</i>	2,508,215	10,000	323,000	106,667
29	Saugor City . .	8,50,507	..	..	..			
30	Rajmunda City . .	4,13,250	..	..	..			
	<i>Carried over Rs.</i>	2,32,70,513	..	41,75,000	16,00,000						

MR. H. LANE BROWN called and examined.

4,102. (President.) The witness stated that he was the head of a firm of consulting engineers in the United Provinces whose headquarters were at Lucknow. The firm were primarily sanitary engineers, but they also undertook the design and construction of buildings when they had not a sufficient amount of sanitary work in hand. They employed a fully qualified and trained engineering staff, but possessed no architect of their own.

4,103. In connection with the contention in his written statement that the present system under which the Public Works Department carried out works was certainly not economical as compared with private enterprise, he remarked that it would be a pity to cite as an illustration in support of this contention a concrete

case, since such an example might not deal with the matter fully. His firm had recently been employed by several local Governments and departments of government, and he was perfectly convinced that if that arrangement had not been found to be both suitable and economical to the firm's employers the latter would not have received the work they had. Every government work which the firm carried out was subject to criticism by the Public Works Department and it was perfectly certain that if that agency had been able to bring in any points against the work of the firm they would have surely done so, since such action would have fallen within the scope of their duties.

4,104. In support of a further contention of his that the work of the Public Works Department could not

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[Continued.]

be carried out as economically as that undertaken by a private firm because the supervision charges of the former were inelastic, he stated that the latter were not obliged, as the former were, to maintain a permanent pensionable staff. Further, that it would be impossible for a private firm to carry out works cheaper than the Public Works Department if they had to meet the amount of supervision and inspection charges that that agency met. A private firm was not also, as was the case with government, obliged to keep on their staff and meet the expenses of men to whom they had no work to give. He added that he had been informed that the supervision charges of the Public Works Department had occasionally amounted to as much as 30 per cent.

4,195. In explanation of his statement that "in a pensionable permanent service, the standard of efficiency must be lower than that permissible in a private agency" he stated that in a pensionable permanent service like the Public Works Department it was quite possible for government to be obliged to entertain individual members of the cadre in a way that a private agency could not and would not. By this statement he did not wish it to be inferred that government were more tender-hearted employers, but that it was more difficult for them to dispense with the services of their inefficient. His own firm would experience the same difficulty if the members of their staff were permanently instead of temporarily employed. Consequently, so long as it was thought advisable to retain the Public Works Department, it would be an improvement if the staff of that agency were recruited on temporary terms similar to the practice adopted by private firms, with the provision of a suitable provident fund arrangement.

4,196. The rates at which the Public Works Department constructed works in the United Provinces were not low, as a rule. On the contrary they were usually about sufficient to permit of the employment of reliable firms and lower rates should not be encouraged. He explained that the statement to this effect in his written evidence referred only to the United Provinces and added that, though he had been requested to furnish evidence to the Committee by the Central Provinces Administration, in view of the fact that he knew more about conditions in the United Provinces, he had declined that invitation and had elected to appear for examination at Allahabad. By his contention that there was nothing wrong with the Public Works Department rates in the United Provinces he did not mean that it was not possible to have work performed at lower rates but he believed that the rates in question were framed elastically by the Public Works Department inasmuch as while one contractor might be allowed rates that were about 2½ per cent. above, another might be given rates that were as much below those contained in the government schedule. He, however, stated in this connection that he possessed no inside information regarding the Public Works Department rates. He added that unless competition were encouraged government could not well expect to secure lower rates, and that though such a practice might please the financial authorities, who would consider an engineer who adopted it to be a good officer, it was not advisable. He personally would sooner allow a capable man higher rates in order to ensure efficient work.

4,197. Rates should be maintained at a level which would constitute a living wage for a contractor, irrespective of tenders. He disapproved of the system under which works were thrown open to tender and the lowest invariably accepted. To the contention that neither government nor anybody else would be in a position to know what would constitute a contractor's living wage without inviting tenders, he replied that it was the duty of an engineer to make himself acquainted with the prime cost of a work, and that to ensure this engineers should in the early days of their service carry out works personally. To make this possible, he suggested the constitution of small divisions where junior engineers might learn to manufacture their own bricks and lime, and added that he personally made it a practice whenever he recruited an engineer from England to the staff of his firm to see

that that individual learnt how to manufacture lime and by this means rendered impossible deception by contractors as to the rates for lime. Rates should be fixed with reference to the experience of departmental work rather than with reference to the cost of tenders received for contracts. In support of this contention he mentioned that in his 30 years' experience of engineering he had found that the best results had been obtained by the Ecclesiastical Commissioners, whose resident engineer he had been, in England because their rates had been framed by their own engineers. In England it was not the usual practice to accept the lowest tender, because that tender in many cases was put forward by an unreliable contractor. The lowest tender was only accepted when the engineer concerned was satisfied as to the reliability of the firm that had put it forward. Contractors in England were always eager to be included in the list of contractors maintained for the works of various bodies, and it was scarcely ever necessary to complain of any of them. A black mark against a contractor in that country meant that the individual concerned was not subsequently allowed to tender.

4,198. A list of reliable contractors should always be maintained and rates that would constitute fair remuneration allowed. Contractors who did not prove satisfactory should be black-listed very severely. He agreed that in order to avoid swamping of young contractors the list maintained should be a classified one, based on the financial ability of the several contractors to carry out either large or small works.

4,199. For the last eight years or more he urged that as a matter of fact government in the United Provinces, Public Works Department had, so far from employing private enterprise, discouraged that agency. This applied more especially to the designing and execution of sanitary projects, both water-works and drainage, but from buildings and roads works too private enterprise had been rigorously excluded, until last year when the Education Department, (not the Public Works Department, but government themselves) had handed over to his firm about rupees ten or eleven lakhs worth of school buildings to design and construct. In spite of the fact that the firm happened to be the only firm of consulting engineers in Northern and Upper India, they had never been consulted in any shape or form at any time in regard to work relating to buildings and roads. Existing private firms should be employed more largely and in preference to the system under which the Public Works Department designed their own building works, in order that the growth of other firms might be facilitated and private enterprise expanded. He disapproved of the system adopted by government during the last three or four years under which a Government Architect had been employed to design government buildings, and recommended that such work should be given to private architects in the usual way in which it was let out to such agencies in England.

4,200. His firm were prepared to design buildings on payment of a fee of 2½ per cent. on the estimated cost of each work. He was here informed that figures had been furnished in evidence which had shown that such a practice was extraordinarily expensive, and more so than the present arrangement under which the Government Architect prepared designs for government buildings. An independent profession of architects if established in this country would, in his opinion, not only facilitate the securing of architects by private individuals to design their buildings, but would also lead to the general advancement and encouragement of architecture in the country. In Bombay, for instance, a large number of the buildings that were at present given to the Government Architect should be designed by the private architects established there. He did not disapprove of Government Architects being permitted to take up private practice if it were considered desirable to retain them, but did not think it essential that government should employ whole-time officers and suggested their being paid a retaining fee. He added that whole-time Government Architects were also likely to become stereotyped in designing work and that government might secure greater variety and better

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[Continued.]

work from the open market where it was not so possible for architects to become stereotyped.

4,201. During the last ten years about 80 to 90 per cent. of the designing of the public buildings erected in Lucknow had been monopolised by government engineers who had also carried out the construction. Such works comprised both government and quasi-government buildings. His firm were at present engaged on the construction of a palace for the Rajah of Mahmudabad who had not requested the assistance of the Public Works Department. In Nagpur too, during the last three years, about the same percentage of public buildings had been constructed by government agency, and as examples he cited the secretariat, council chamber and post office. He did not include in this statement the large new suburb that had sprung up within the last few years in Craddock Town because at present the ordinary pleader's dwelling and Indian type of house of which that suburb was chiefly composed was not worth very much and did not demand the services of an architect, being designed apparently in most cases by the owner with the aid of a sub-overseer or *mistri*.

4,202. He did not agree with the contention of a previous witness that government buildings in Cawnpore formed only a small proportion of the total amount of building work in that city, but on the contrary thought that the principal buildings there belonged to government. He assumed that the previous witness had included as non-government buildings a large number of factory and mill works in Cawnpore which did not necessarily require the services of an architect.

4,203. In his opinion the Government Architect possessed a monopoly of the government work in the United Provinces, and if both that officer's appointment and that of the Government Sanitary Engineer were retained on the same basis as they had hitherto existed for the last eight years, and construction of government works was in future entirely monopolised by government officials, the effect would be to retard any possible growth of architecture or sanitary engineering in the province. He admitted, however, that in England when a particular individual, firm or private body had sufficient work to justify the employment of a whole-time architect that course was adopted in preference to the system of open competition, but pointed out that such whole-time architects were not engaged on a permanent pensionable basis as the Government Architects were in India. Consulting architects in England, though retained for the whole of the work of particular departments, such as the Department of Education, were allowed to take up private practice as well and in many cases large municipal corporations in that country did not confine themselves to the employment of their own consulting architects. Works in India should accordingly be carried out under the same system as that adopted in England and not by the employment of whole-time officers.

4,204. He advocated that both the designing and construction of sanitary works should be left largely to private enterprise and not, as a rule, undertaken by government. Since, however, he knew, of no other private sanitary engineering firm besides his own in India, he admitted that the effect of the acceptance of his recommendation would be that, at least for the present, all sanitary works would be monopolised by his firm, but he pointed out that this would merely amount to reversion to a former practice.

4,205. In regard to the list furnished by him with his written statement of sanitary works in the United Provinces that were either designed only, or both designed and constructed by his firm, he mentioned that it had not been the case that those works were given to the firm before the appointment of the Sanitary Engineer to Government because that appointment had been in existence when he first came to the province 18 years ago. The recent change which he had noticed in the policy of government in connection with the employment of private enterprise had not been due to the appointment of a Sanitary Engineer, but to some other reason so far as the United Provinces were concerned.

4,206. If government decided to retain the appointment of Sanitary Engineer they should insist on candidates for that appointment being men with thorough sanitary qualifications. Hitherto the post had been occupied generally by men without proper, and occasionally without any, sanitary qualifications, and of the thirteen Sanitary Engineers he personally had had experience of he knew of only two who had had a previous knowledge of sanitation and that experience had been confined solely to a knowledge of water-works. Personally he was in favour of the retention by government of their Sanitary Engineer, provided each such individual had had a thorough sanitary grounding and that his duties were confined to scrutiny and advisory work only. He disagreed with the contention put forward in evidence that, since sanitary work in India was at present in a more or less rudimentary stage, it was more important to secure for the post of Government Sanitary Engineer an individual with experience of Indian conditions and more especially experience of rural and town life in India. His own firm had designed projects worth nearly two and a half million pounds in India alone, which amount would be considered a fairly large sum in any country in the world, and it appeared to him that it would have been a very hazardous endeavour to carry out works of such magnitude with officers who had never been trained in sanitation nor had experience of large sanitary schemes. Further, sanitary difficulties met with in India were different in some measure from those encountered in England. In certain cases in India, moreover, it was necessary at times to give up the best design and make a compromise in order to meet a financial situation. A certain amount of time was also absorbed before views could be altered sufficiently to meet local circumstances and in such cases the Indian-trained Sanitary Engineer found himself usually at a loss on account of his inexperience of sanitary works of any magnitude. The witness personally did not know how this state of affairs could be rectified.

4,207. He had been brought out from England by government in 1898 because at that time the local Public Works Department needed the services of a trained sanitary specialist, but since he found himself unable to cope single-handed with the amount of sanitary work available, he had secured the services of other men from England with sanitary experience.

4,208. The functions of the Government Sanitary Engineer should be confined to scrutinising projects prepared by private enterprise and the supervision of the individuals who undertook to construct sanitary works, whenever a private agency competent to design and construct such works existed. This had hitherto been possible by the presence of his firm in the Frontier Province, the Punjab, United Provinces, Central Provinces and in parts of Bengal, but not in Madras. He viewed the Sanitary Engineer to Government as an officer specially deputed to advise government and scrutinise projects, and suggested that that officer should be maintained in the position of an independent officer of government not doing comparable work side by side with private enterprise, or trying experiments. He added, however, in this connection that there were at present no contractors in India who were capable of constructing sanitary works, and that this was the sole reason why he carried out construction himself. The largest and best firm of contractors in India that he knew of was probably a certain firm in Calcutta, but when he first went to Benares where that firm had under construction sewerage works worth about rupees three lakhs, he found that they had not made a success of the work and had asked for the rates to be increased by about 40 per cent. with an indemnity against all damage claims. He carried out the works in question departmentally under the scrutiny of the Sanitary Engineer to the local Government. The above remarks related, he explained, to such sanitary works as were more especially drainage and sewerage works and did not apply to water-works. In his opinion the Calcutta firm had not been able to construct the Benares works referred to above because the latter were not sufficiently remunerative. In view

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of these facts he recommended that the firm to which the preparation of the design of a sanitary work was entrusted should under existing conditions in India also be allowed to construct the work departmentally under the supervision of the Government Sanitary Engineer, as was the present practice of his own firm, and that such a system should continue until it was possible to obtain suitable contractors. In other words, under proper and sufficient government scrutiny, there was in his opinion no objection to the firm which designed a work also undertaking its construction.

4,209. He confirmed the suggestion in his written statement that municipal bodies should be permitted to employ private firms and explained that, though under the rules such bodies were allowed to adopt this course, the rules themselves which he had read did not appear to him to be operative and had not been strictly adhered to within the last seven or eight years. Municipalities could obtain doles from government, but such doles were to a large extent under the control of the Public Works Department, inasmuch as when each was made it was left to the Sanitary Board to decide as to the agency which should design the project concerned. He admitted, however, that this was not the case in the Central Provinces, but added that municipal bodies in the United Provinces did not possess a free hand in respect to their sanitary works and that private enterprise had been definitely excluded from such works by the Sanitary Department of the Public Works Department through the Secretary to Government in that Department.

4,210. The best system at the present time for the construction of drainage and sewerage works in India was the system of departmental construction followed by his own firm. Under this arrangement the firm employed sub-contractors only for the supply of labour and not for the supply of materials. The firm themselves manufactured their own lime and purchased all the other main materials required by their labour contractors. It was essential, in order to obtain a good quality of lime, to manufacture it personally and not purchase it from a sub-contractor. He disapproved of the suggestion that the construction of sanitary works should under present conditions be opened out to the tenders of large contracting firms, quoting the fact that the Calcutta firm had failed when so employed at Benares.

4,211. In regard to a statement put forward in evidence that certain plans prepared by his firm had subsequently needed a great deal of alteration and recasting, he asserted that the point really required very little argument or explanation as, since 1898 up to about eight years previously, his firm had designed practically all schemes in the United Provinces. Public Works Department engineers had only latterly exhibited a tendency to try their own staff on such work, although for ten years or more there had not been a doubt in anyone's mind about the suitability of the plans his firm had prepared. Other provinces, as for example the Central Provinces, had also sent their engineers to see the work of the firm during construction and to examine how their projects were designed and carried out and a very large amount of work had, as a result, been entrusted to them in other parts of India. This more or less proved that the opinions of the engineers of the Public Works Department who had complained of his firm's work were not supported by the opinion of engineers in other provinces or by actual experience. He mentioned two instances in which plans prepared by his firm had subsequently had to be considerably altered—one connected with Allahabad and the other connected with Saharanpur—and explained that in the case of the former, although he had pointed out that it was unsuitable to carry out the instructions he had received from the local Government through the Sanitary Engineer (who also had made the same objections), the Lieutenant-Governor had insisted on their being carried out and the scheme had been framed according to the directions which the firm were given. The firm were expected to do what they were told and hence, after they made their protest, they carried out instructions. The Saharanpur project had in a similar manner to be wholly recast by the firm at a cost of over £1,000 in

order that it might meet the wishes of a newly appointed Government Sanitary Engineer (who had had no previous experience of sanitary work), although the original project was got out to the specific instructions and with the approval of his predecessor. After this the firm received no work in the United Provinces.

4,212. His firm had entered into three separate agreements with government in connection with projects in the United Provinces. The first was for the supply of the design and estimate of a work at a charge of either 2 or 2½ per cent.; the second was for carrying out supervisory work in such cases where the municipality concerned did not possess a construction staff of their own, at an additional charge of 5 per cent. In no case however had any of the municipalities possessed a staff sufficiently competent to construct a work. The third agreement was similar in form to that entered into in Nagpur by the firm, in accordance with which they were paid at 17 per cent. Under this form of agreement the firm provided the whole of the clerical and technical staff necessary to carry out a work and their charge of 17 per cent. was in addition to the 2½ per cent. paid them for the preparation of the design. He amplified these remarks by stating that in the Central Provinces the firm had accepted (at the instance of Mr. Harriott the then Chief Engineer) fees for preparing designs on a system entailing the payment to the firm for each project of a lump sum based on an average amount per head of the population in the municipality concerned. This average fee had been four annas per head of the population in the Central Provinces and had worked out to about 2 per cent. Mr. Harriott considered such an arrangement better suited to certain of the municipalities in the Central Provinces than the practice followed in the United Provinces.

4,213. His firm had undertaken both to design and construct certain educational buildings in the United Provinces on behalf of the local Department of Education. Under the agreement entered into for those works the firm had been allowed the liberty of constructing each of the works in any way they considered fit, either through contractors or departmentally, and were only responsible for making over each completed building to the Education Department for a certain lump sum. The plans of these works had, however, to be submitted to the Chief Engineer of the Public Works Department for approval and such alterations as that officer suggested were complied with by the firm. The estimates were based on the Public Works Department schedule of rates in force in the several localities concerned, and the Education Department had arranged for the supply to the firm of that information. The firm were not able to put high rates in their estimates because the basis of those estimates was the Public Works Department rates and the estimates themselves would if necessary be referred by the Department of Education to the Public Works Department. Hence it was only possible for the firm's rates to be equal to or lower than those of the Public Works Department, and as a matter of fact in every case they had actually been lower than those contained in that Department's schedule extant in the particular district concerned. As exceptions to this rule, however, he mentioned iron and steel-work, the rates for which were, owing to present abnormal conditions due to the war, usually in excess of those contained in the Public Works Department schedules which would, of course be, equally liable to those enhanced rates.

4,214. During construction of the school buildings the Director of Public Instruction had power under the agreement entered into with the firm to have the works inspected by any agency that he chose to appoint for the purpose and as frequently as desired but, as a matter of fact, the witness had informed the Director of Public Instruction that if this power were exercised he would view such action as connoting a want of confidence in his firm. Hence the result had been that no supervision other than that exercised by the firm themselves had been undertaken on behalf of the Education Department during progress of construction. He added that the Educational Department had suggested to government that his firm should be appointed consulting architect

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tools to that department—government had not agreed to this and the firm had also stated that they could not accept such a position unless they secured an architect of their own on their staff. At present they were not in any way architects, nor did they consider themselves as such.

4,215. The same allowance as the Public Works Department allowed, viz.:—5 per cent., was made by his firm for contingencies in their estimates. Their estimates did not however include an allowance for works establishment, etc., they did not put down in an estimate the number of *mistri** required and the monthly cost of such individuals for the period they were likely to be employed; nor did they include an allowance for tools and plant. The firm received, however, a certain sum for supervision which amounted to $7\frac{1}{2}$ per cent., and this with the 2½ per cent. charged by them for the preparation of estimates made up their total charge of 10 per cent. To save time they made it a practice to deduct 10 per cent. from the Public Works Department rates to meet their charges.

4,216. In each agreement entered into by his firm with the Education Department a time limit had been fixed, but that limit had not been observed. As reasons for the delay in some instances he mentioned the difficulty experienced by the firm in obtaining steel-work in the open market owing to the war and also the long rainy season encountered in the previous year. The firm had undertaken to complete works worth about rupees seven lakhs in seven months and there would have been no difficulty had the arrangements for such works not been made too late. The contract had, however, for the reasons he had given, been interpreted elastically but in spite of delay the arrangement had proved satisfactory to both the Education Department and his firm.

4,217. According to the agreement entered into with his firm for each school building sums had to be paid to them periodically for actual work performed, but in practice the whole of the funds had been paid to them months before the buildings were completed. The firm had opened up an account in regard to each building with the Bank of Bengal and government had deposited the amount to be paid them in that Bank. They drew on the sums credited to their account as they required funds and in this way it might have happened that they had actually received payments in advance. But though in each case the contract might have been infringed, inasmuch as the firm might have received certain sums considerably in advance, he urged that since they were not contractors they were not able to carry out departmental work on behalf of government entirely on their own resources, and that the method in which the payments had been made had been entirely in the hands of government.

4,218. In connection with the suggestion contained in the rules he had proposed in his written statement, that inspections should be limited to three* in number and carried out by the Superintending Engineer, he remarked that he had suggested this limit because the agreement that had been entered into between his firm and government, irrespective of the Public Works Department, was not one which he thought was really satisfactory. If the firm had been consulting architects such a form of agreement would have been practically correct, but as they were not contract employers and only accepted works piece by piece it had been said that they objected to inspection by the Public Works Department. They did not as a matter of fact object to such inspections if they were made by an administrative officer of the Public Works Department like a Superintending Engineer, and not by an Executive Engineer who might be doing comparative work in the same town or had done such work. The three inspections should be undertaken at the following stages of construction, the first on completion of the foundations, the second just before the roofs were put on and the last after completion of the

building. There had been no inspections undertaken on the first five buildings his firm had received, and certain such buildings had only been seen by Superintending Engineers of the Public Works Department, not on behalf of that agency or the Education Department, but because those officers stated that they had to give evidence on the work of his firm before the Committee. He desired that his firm should not be allowed to proceed with the construction of a building until they had received a certificate from a Superintending Engineer that that officer, on the part of government, was satisfied with the stability of the building. He considered that with three inspections such an officer could form a satisfactory opinion on the quality of the works and that this would make the issue of a satisfactory completion certificate possible.

4,219. He had made the proposition that his firm should undertake the maintenance of the educational buildings constructed by them for a period of three years, on payment to them of a percentage of $1\frac{1}{2}$. He had originally suggested that a period of ten years might be fixed and was prepared even now to maintain the works for that period, but added that he had accepted the suggestion and agreed to three years. To the contention that it was easier to maintain a new building at a charge of 1½ per cent., for three years, but a difficult matter to do so for a longer period, he replied that it depended on the building itself whether this was the case or not. In the United Provinces buildings of the terraced-roofed pattern were in vogue, and his firm were at present maintaining a large hotel at Lucknow that had such a roof. The firm possessed a staff which went round and inspected buildings and carried out repairs, and charged for actual maintenance.

4,220. (Mr. Cobb.) The three inspections he had proposed of such works as his firm undertook to construct on behalf of government should be undertaken by an independent government engineer because the works involved an outlay of public funds. In connection with the school buildings referred to previously, he admitted the existence of a permissive clause covering inspections in the agreements, and reiterated that he had informed the authorities concerned that if inspections were undertaken, such action would be viewed by him as a want of confidence on their part in his work.

4,221. The rates his firm had put forward in connection with the school buildings had been arrived at by deducting 10 per cent. from the Public Works Department rates and resulted in a decimal figure rate for each item. Hence the result was that the work was done by the firm at Public Works Department rates inclusive of supervision. The average Public Works Department supervision charges taken over a period of five years amounted to 10 per cent. additional to the rate charges.

4,222. It was not he who had requested the Calcutta firm to tender for the Benares project, because that scheme had been framed, before he came to the province, by government engineers. He was appointed resident engineer for water-works and sewerage, but though engaged by government he was paid by the municipality. Work amounting to rupees three lakhs had been practically completed by the Calcutta firm before he arrived at Benares and that firm had stated that they had lost Rs. 45,000 mostly in damage claims, they then claimed total indemnity for damages and also asked for 40 per cent. increased rates. When government asked him to undertake the work he pointed out that he knew nothing of the local conditions, e.g., rates, etc., and that he was being asked to do about three times the work he had been engaged for. He, however, completed the works for government departmentally and settled all the details, and the course taken was in his opinion better than if the Calcutta firm had been allowed to proceed with the work. He expressed himself as perfectly certain that if the Calcutta firm had engaged him instead of their own engineers they would have been able to complete the Benares work, because they had attempted to carry out those works with engineers who had little or no previous knowledge of drainage construction work.

* Since this evidence was given, the three inspections suggested have been agreed upon between the firm and the Government of the United Provinces.

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4,223. (*Rai Bahadur Ganga Ram.*) Of the Rs. 382 lakhs of projects undertaken by his firm actual construction work had involved about Rs. 64 lakhs or about one-sixth of that sum. The works that had been constructed had all been sanctioned and paid for, but the other works had been held over for want of funds, e.g., Rs. 42 lakhs were involved in connection with a scheme for Lahore and out of that sum not a pice had been spent on actual construction. The sums referred to comprehensive schemes that had been framed but held in reserve against future piece-meal expenditure.

4,224. Four annas per head of the population was the fee his firm had been paid for the Lahore project. Hence, as the population of that city was only about 200,000, the firm had received Rs. 50,000. This fee was practically equivalent to 2 per cent. of the estimated cost of each work. The firm received either 4 annas per head of the population concerned or 2 per cent. on the cost of the whole of each project whichever the government preferred to pay them. As a matter of fact the local Governments concerned preferred the former method in order to meet any objections that might be raised by members of municipal boards and committees.

4,225. On being asked what real objection he had to his firm being designated contractors and whether such a designation was derogatory to the profession, he replied that the term "contractor" implied as much derogation in his case as would be implied if the expression "compounder" were applied to a medical man qualified as a "doctor," and consequently also in a position to compound medicines that might be prescribed.

4,226. (*Mr. Mackenzie.*) It was not difficult in England to dispense with the services of contractors who had been enrolled on government or local bodies' lists. Certain of such contractors he had known had been on a list for many years and yet were but the residue of the total number that had been listed. Only about one individual in every four had been kept on for this period. He did not think it would be difficult to utilise the black list he had suggested for contractors in India. The case of inefficient officers of the Public Works Department was not analogous in his opinion to that of contractors. The former were kept on owing to natural reluctance to dispense with their services on the part of the authorities concerned and owing to their vested interests in permanent posts, and these arguments were sufficient to distinguish their case from that of contractors.

4,227. His firm did not look upon themselves as being in the same position with regard to their clients as that occupied by a clerk of works in Europe. They held themselves responsible for the soundness of their work and did not trust to a clerk of works, but to their own staff. They placed a resident engineer on practically every work, but for the past three or four years, as certain of their officers were on service, they had been obliged to rely on their subordinate staff to a greater extent. Though their system might be expensive to themselves he considered it a very necessary procedure. To the contention that it appeared that his firm was in charge of both their own interests and those of their clients and in that way combined two possibly conflicting functions, he replied that the firm did not benefit from the works as works since they received but their percentage for supervision only.

4,228. (*Mr. Willmott.*) It was on the then Chief Engineer's recommendation that the services of the firm were no longer utilized in connection with drainage and sewerage work in the United Provinces. He did not

know whether the Chief Engineer, who certainly disagreed with the officers who had previously held that appointment, had also disagreed, when that particular decision was reached, with the Sanitary Engineer.

4,229. There was no question of his firm not complying with the suggestions for modification of their designs for school buildings that might be made to them by the Chief Engineer. He was asked how it was that the same defects were repeated in subsequent schemes, but he denied that this was the case, save perhaps in regard to very minor details. The criticism, he also added, could not be applied to all designs.

4,230. In the case of a school building contract there might possibly be alterations, and if an alteration were desired outside the 5 per cent. allowed for contingencies in the estimates it would have to be resubmitted as a supplementary estimate. The case had not arisen on any of the buildings in hand.

4,231. In connection with the practice of his firm of deducting 10 per cent. from Public Works Department rates to meet their own charges he remarked that when the war was over it would not perhaps be possible to get work carried out at these rates. His firm did not even at present find the 10 per cent. rates to be remunerative and had settled with other provinces for the payment to them of 15 per cent. for certain educational buildings. The supervision charges of the firm included everything.

4,232. He objected to anybody doing comparable work undertaking supervision as it might unnecessarily engender friction. He did not consider it fair to ask whether in his opinion it was impossible to give such men instructions so that they might not act in the capacity of Executive Engineers but in that of Inspectors. His opinion was, he explained, based on his general experience, and he added that if he went down to say Akola in the Central Provinces to build a school and worked as through and for the Public Works Department the whole of the subordinate staff of that agency would be with and not against him. His firm worked as part of the Public Works Department in the case of the sewerage work at Nagpur. He emphasized that Inspectors should not be officers who carried out work alongside that of a private agency because it might engender friction.

4,233. He recommended that Superintending Engineers should receive at least two months' notice to undertake an inspection and considered it quite possible to give a notice of this length. It would be necessary to meet the convenience of such officers in this respect.

4,234. He confirmed his contention that his firm were willing to undertake the maintenance of the educational buildings they had erected for a period of ten years and reiterated that he had personally suggested this length of time. He was also not averse to the fixing of even a longer period, and to the contention that, in such an event, it might not be possible for government to know the result of the trial of entrusting maintenance work to the firm, he replied that he did not know why difficulties need be anticipated in view of the fact that they did not occur in connection with similar work the firm had undertaken for private persons. He did not wish it to be inferred that the fee of 1½ per cent. for maintenance work was the minimum that the firm would take. It was the percentage charged for similar maintenance by the Public Works Department on their own buildings and which he had suggested as the basis for works not only in the United Provinces but also in the Central Provinces and elsewhere.

W. BELL, Esq., Electric Inspector to the Government of the United Provinces.

Written Statement.

4,235. (I.) Economy and suitability of methods of execution of public works, and (II.) Encouragement of other agency.—The chief object of the Committee of inquiry is obviously to find out if it is possible to encourage private enterprise to a greater extent. I am not in a position to say if this is possible with regard

to buildings and roads, but I have no hesitation in stating that in these provinces much better results are obtained when electrical works are carried out departmentally. At present electrical work to any extent is only carried out by a few European firms with headquarters in Calcutta and Bombay. In these cities there is no question that the work is of good quality and the

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prices reasonable. Up-country however it is an entirely different matter. In the majority of cases the engineer sent to supervise the work is not capable and it is questionable if a qualified man can be obtained at the salary usually paid by the contractors for "up-country" supervision. As far as Indian electrical wiring contractors are concerned in the majority of cases a great deal is left to be desired and I consider that government is to a great extent responsible for this as no attempt has been made to legislate for electrical works as has been done in the case of water-works. In my opinion the time has now come for the licensing of all wiring contractors. This step is necessary in the interests and for the safety of the public.

(2). I may here state that in these provinces it has hitherto been customary to encourage private enterprise as far as possible in connection with government electrical installations. I regret to say that this has not been a success; hence most work is now being done departmentally.

4,236 (IV.) Relations with other departments and sub-branches.—I think that on the whole the Public

Works Department meets the needs of the other departments of the administration but an improvement would be effected if a Sanitary Branch could be formed. In these provinces the Sanitary and Electrical Departments work to a great extent hand in hand, being chiefly engaged on combined water-works and electrical projects. It would also be in the public interest if a mechanical engineer were appointed, as many of the projects require the services of a specialist in mechanical engineering and it is obviously impossible for a man to be a specialist in sanitary, electrical and mechanical engineering. I would therefore suggest that a third branch be formed with a Chief Engineer on the usual scale, assisted by an electrical and mechanical engineer with the rank and salaries of Superintending Engineers. At present it is customary for municipalities to pay contractors a fee for the inspection of their water-works. This is open to objection in my opinion, as plants, other than those supplied by the inspecting contractors, are liable to be less carefully inspected. These inspections should be carried out by a government mechanical engineer. The same remark applies to the inspection of electrical batteries.

MR. W. BELL called and examined.

4,237. (President.) The witness stated that he was at present officiating as Electric Inspector to the Government of the United Provinces in place of the permanent incumbent who was on military duty. His permanent post was Electrical Engineer, Mussooree Hydro-electric Scheme, a municipal scheme, and he was at present performing the duties of Electric Inspector in addition to his ordinary duties.

4,238. He had had experience of government and municipal electrical work and was of opinion that both construction and maintenance work should be executed departmentally. He had worked both departmentally and by contract in connection with the Mussooree scheme and had achieved more satisfactory results under the departmental system which, though not more economical, was productive of better results. The Mussooree Municipality had decided in favour of the departmental system after having tried a firm of electrical engineers as contractors. No charge was made for supervision performed by the permanent staff as it was employed whether the work was executed departmentally or by contract. He had had experience of practically all the large electrical contracting firms in Mussooree and besides had had experience of work in several districts in the United Provinces, since his appointment as Electric Inspector in April 1915, and found that the departmental system had resulted in better work in all cases and had not involved any extra expenditure. It had been customary in the United Provinces to get electrical work done by contract, but as this method had proved unsatisfactory it was abandoned in favour of the departmental system.

4,239. There should be a system of licensing for wiremen as there was a tendency for small contractors in towns like Allahabad and Lucknow to set up as electrical wiring contractors and to put in unsatisfactory wiring in houses. The public could not recognise good wiring or good switches and employed the contractors in question as they quoted rates less than the market rates, but the work of such contractors was attended by great risk of fire and danger to human life. There was insufficient provision in this connection in the Indian Electricity Act which accordingly required amendment. He had no power to interfere in such cases if the insulation test was satisfactory.

4,240. His executive duties as Electric Inspector consisted partly of the maintenance of government installations. There were about 20 to 30 government installations in the province and projects worth about Rs. 70 lakhs were in hand. He was not in direct charge of the government installations, as they were in charge of the various sub-divisional officers of the Public Works Department and he had only to inspect them. The sub-divisional officer in Lucknow had charge of about

10 installations. There were about 50 government power plants in the province. These, however, were not large, the largest being of about 150 kilowatts and the smallest of 5 kilowatts. He was merely required to inspect such plants as they were in charge of electricians attached to divisions at various centres. He did not consider this arrangement suitable and advocated that the Electric Inspector should be placed in executive charge of all the installations and given the necessary staff, as Executive Engineers were not in a position to decide whether indents drawn up by electricians were necessary or not.

4,211. He was also required to prepare such projects as were called for by government. These were not small but were large projects like the hydro-electric schemes for Meerut and Naini Tal and for other big cities. His functions in such cases were confined to the preparation of the electrical portion of the schemes. The question of the preparation of such schemes by the municipalities themselves was at present under consideration, but in the meanwhile they were being prepared by government on behalf of the municipalities. He possessed no staff for the purpose and was obliged to do the whole work himself. He had not been consulted by a private firm in connection with any private electrical scheme in the United Provinces, but he had been consulted regarding a scheme in the Punjab. No private firm had yet asked his advice on a proposal to take up a license for an electric power and light scheme.

4,212. His statutory functions under the Indian Electricity Act related to the settlement of disputes between consumers and supply companies regarding the accuracy of meters. He was also required to inquire into any accidents caused by the use of electricity. During his tenure of office as Electric Inspector there had not been a single dispute as to the accuracy of meters between private individuals and supply companies nor had there been any such dispute between government and the companies.

4,213. He agreed with the contention that it was undesirable that the Electric Inspector, who was responsible for the interests of government in regard to electrical work, should also exercise statutory functions under the Indian Electricity Act and settle disputes which might arise between government and supply companies. He therefore suggested that the Electrical Adviser to the Government of India should be the arbiter in such cases.

4,214. He had no official relations with the Electrical Adviser to the Government of India; if he were in any difficulty the local Government could refer the matter to that officer. The United Provinces had no need for the services of the Electrical Adviser as the province

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was quite self-contained, and all the Electric Inspector's duties, executive, statutory and advisory, could be performed quite satisfactorily without the aid of the Electrical Advisor.

4,245. Electrical stores were as far as possible purchased from firms in India and the supply had been found satisfactory. There was no necessity for indenting for such stores on the India Office. He had not had much experience of stores purchased by indent on the Secretary of State, but was aware that there was always considerable delay in procuring the stores. When a machine was bought by indent in India final payment was not made until the machine passed a test at site, as it was possible that it might pass the test in England and might when tested in India turn out to be unsatisfactory. He himself was not in a position to carry out tests of stores locally purchased as he had neither an electrical laboratory nor the instruments for the purpose. If he were supplied with the instruments, however, tests could be made equally well, or even better, in India than by the India Office in England.

4,246. He had made a comparison of the cost of purchasing stores in India and in England, and had found that electric lamps could be had cheaper in India than in England. He was therefore of opinion that no economy would result from effecting purchases through the India Office. In the case of the Mussoorie hydro-electric scheme, the cost of which was about Rs. 10 lakhs, all the stores were purchased locally through the agents of English firms which had their offices in Calcutta or Bombay and no direct purchases were made from England.

4,247. He came out to India in 1910 as Chief Assistant in connection with the Mussoorie scheme. The best method of recruitment of government Electric Inspectors was to continue recruiting such officers from England in preference to recruiting them from among the electrical engineers employed by private firms in India, but Public Works Department officers who had specialized in electrical engineering should be given the prior claim.

4,248. With reference to the contention that the work done by private electrical contracting firms, especially in the presidency towns, was quite satisfactory and that the system of execution of electrical work by contract was in such cases better than the departmental system, he explained that this was due to the fact that, as the presidency towns were the headquarters of such firms, they maintained a competent engineering staff in those cities. On the other hand when firms took up a contract in an up-country station, worth about Rs. 25,000 or a lakh, they could not afford to provide expensive supervision and consequently detailed incompetent subordinates for the purpose and this had resulted in unsatisfactory work. There had been cases where departmental labour had had to be employed to complete a work which had been carried out improperly by a private firm, and he was aware that this had also occurred in Delhi.

4,249. (Sir Noel Kershaw.) The system of executing works departmentally had been in force since August 1916, and the defective results due to the employment of private enterprise were largely due to the inefficient engineers who were sent by the contracting firms to supervise the works. He had on several occasions drawn their attention to the matter, but they had been unable to remedy it. It was true that his experience as Electric Inspector was not extensive, but he had experienced the same difficulty in connection with the Mussoorie scheme.

4,250. The time was ripe for the introduction of a system of licensing wiremen, and the municipalities might be authorized to issue licenses. For this purpose it would be necessary for government to frame a standard specification showing the quality of work which a man receiving a license was expected to do. The majority of the public were not sufficiently aware of the danger of accepting work of a lower specification.

4,251. (Rai Bahadur Ganga Ram.) He had received a training as a mechanical engineer and was competent to put up a Diesel oil engine and dynamo independently.

4,252. His statement that electrical stores could be

purchased cheaper in India than in England was based on a comparison of the real rates and not on the catalogue rates of firms.

4,253. He was a member of the electrical conference which had been inaugurated by Mr. Meares and had attended both the conferences which had been held. The conference served a very useful purpose as there was no other means of ascertaining what was going on in other provinces with regard to electrical matters.

4,254. (Mr. Cobb.) Contractors resorted to sub-agents for the supervision of their works, but he himself carried out works departmentally subject to his own supervision or that of his Assistant. He did not perform the entire inspection work of the province himself, but had an Assistant Electric Inspector and an Assistant Electrical Engineer for government work and the Mussoorie scheme, respectively. There was an electrical workshop at Mussoorie, and the number of workshops would have to be increased with the growth of electrical work.

4,255. The hydro-electric scheme at Mussoorie was now in operation and he was sure that if any further plant was required for it the work would be done departmentally as cheaply as by contract.

4,256. (Rai Bahadur Ganga Ram.) He had had experience of the students of the Roorkee College and of the Industrial School at Lucknow, but had had no experience of those of the Bombay Technical School. In his opinion the students of the Lucknow school were better than those from Roorkee as the latter were wanting in practical experience and would not undertake manual labour. Apprentices served for two years. The Lucknow man had received Rs. 15 from the Board and something from government in the form of a scholarship. He knew of a man who on passing the final examination of one of the institutes had at one time served on Rs. 15 a month under him, and who had subsequently been appointed by government on Rs. 50 a month; another had started his own business.

4,257. The two Assistants he had were both Europeans and had received a training in electricity. The Mussoorie Assistant was now on active service and had been drawing Rs. 600 a month.

4,258. (Mr. Cobb.) In addition to the two European Assistants he had a power station superintendent and a pumping station superintendent neither of whom could speak English.

4,259. The student from the Lucknow school was merely an apprentice who came to him for training and his services were not retained.

4,260. (Mr. Willmott.) Several of the Calcutta electric firms had started branches in Delhi but none had a branch in the United Provinces. One of the firms had opened a branch for a particular work, but left when that work was completed. As a result petty contractors who were quite unreliable were procuring all the work. Firms would, however, be greatly encouraged in establishing branches if a system of licensing electrical contractors were introduced, as in that case a man who did not work up to specification would be liable to lose his license.

4,261. The fact that the price of electrical stores in Calcutta compared favourably with prices in England was a normal occurrence. It was not at all due to the war as there was a combination in England to keep up prices. For reasons unknown to him, the firms at home did not work up their agents in India to level up the prices in India, but this was not due to American competition as the American articles were cheaper than in England. The practice of the Electrical Branch was to obtain articles of British manufacture only.

4,262. He had never used the Calcutta testing laboratory for testing meters, but had utilized it for testing fans. It was intended mainly for Bengal and was used to a very small extent by the other provinces. The laboratory was worked on proper lines and there had never been any complaint against it. It could not be used for testing plant of the size used in the United Provinces, and was suitable only for the testing of meters and fans.

4,263. All original electrical work was entrusted to the Electric Inspector and he could seek the aid of

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the Executive Engineer if he required it. He did not approve of the present system under which maintenance estimates relating to electrical works were prepared by Executive Engineers in consultation with the Electric Inspector, and considered it was desirable that all such estimates should be prepared by the Electric Inspector, provided that officer was given the necessary staff for the purpose.

4,264. The Electrical Adviser was useful as he was in charge of the Calcutta testing laboratory. He was

besides instrumental in bringing electrical officers together in conference and discussing questions connected with securing uniformity of procedure throughout India in the administration of the Indian Electricity Act, the framing of specifications and the grants of licenses. He might also be useful as a consultative officer, but the witness had not had occasion to refer to him. The Electrical Adviser was useful from a commercial point of view.

C. H. WEST, Esq., Sanitary Engineer to the Government of the United Provinces.

Written Statement.

4,265. (I.) Economy and suitability of methods of execution of public works.—The methods at present adopted for the execution of civil works are good in their way but there is considerable scope for improvement. The amount of time and labour spent by the constructional staff in the preparation of designs and estimates is enormous. These could be much more efficiently done in a central office. I would suggest that only preliminary projects with outline plans should be made out in construction offices. All details and fair plans should be made out in the central office for designs. The second improvement I would suggest is that for a construction division there should be an Executive Engineer, who should have as personal assistant an Assistant Engineer. There would be about three construction sub-divisions under him with upper subordinates in charge. These upper subordinates should be merely responsible for the correct setting out of the work and the quality of the work done under their charge. All payments should be made by the Executive Engineer. He should give out all contracts himself and be responsible for the quality of all materials used, fix the rates to be paid and he or his personal assistant should check all measurements for works.

(2). At present too much is left in the hands of low-paid subordinates. It is not good for the subordinates or for the work. The changes suggested by me will remedy this as far as possible.

4,266. (II.) Encouragement of other agency.—Under the existing system all works are carried out by contract when suitable contractors are available for the work, and to this extent only is private enterprise encouraged. This system does not encourage the growth of large engineering firms. Most of the so-called contractors are merely middlemen, working on a little capital of their own or on capital borrowed from the local *bania* or bank. They generally possess no engineering knowledge nor do they employ skilled assistants, and merely purchase materials in the open market and act as suppliers of labour and more often than not the work to be done is sublet at a piece rate to the actual workmen. This method of carrying out work requires the closest supervision on the part of the engineering staff. Rates are lower than any large engineering firm can work to but supervision charges are higher. To encourage the growth of large engineering firms all contractors must be registered. The number of such firms must be limited to ensure a certain amount of work to keep the firms busy. The minimum qualifications for registration should be that the firm manufactures its own bricks and lime and has a workshop and employs a qualified engineering assistant to supervise its work.

(2). Second and third-class contractors can be registered for supply of materials or labour only, but as far as possible the work should be entrusted to engineering firms of standing. If the number of firms that are registered is too large they will not find sufficient work or profit to keep them going.

(3). It is also asked if it is possible or desirable to entrust the construction and upkeep of certain classes of buildings to agency other than departmental. As explained above all works and repairs are already carried out by contract under close departmental supervision, so that the only further change that can be made is to do away with departmental supervision or to lessen

the amount of supervision employed. If we consider the possible agencies other than departmental which may be taken into consideration for the carrying out of public works in India, the first agency which strikes us in many provinces is the district board engineers.

(4). The district board engineers were abolished in these provinces many years ago and all local works are at present carried out by the Public Works Department. The district board staff, which was abolished was not particularly efficient and this change resulted in an increase of economy and efficiency.

(5). If it is desired to foster the growth of a private engineering profession in India and to increase the number of posts available for them this system of having private engineers employed by local boards would have to be re-introduced, and to get a really good class of men the prospects for district board engineers should be made similar to those of the Public Works Department engineers as far as possible.

(i). No man should be recruited who is not qualified for admission to the Public Works Department engineer grade.

(ii). He should be able to rise to the maximum fixed for Executive Engineers in the Public Works Department recruited from Indian colleges.

(iii). He should be assured that his appointment was more or less permanent subject to his work being satisfactory.

(iv). He should have some sort of provident fund provision in lieu of pension.

(6). For smaller districts upper subordinates should be recruited with similar prospects and qualifications. In some cases district boards could be given the option of employing a firm of consulting engineers in place of a district engineer and his staff if they prefer it.

(7). The procedure for executing works would be similar to the procedure for carrying out municipal works.

(8). A board called the Local Government Board should be created similar to the Sanitary Board in these provinces.

(9). District board engineers would send up projects up to Rs. 10,000 for administrative sanction to the Commissioner, above Rs. 10,000 to the Local Government Board. The Commissioner or Local Government Board would decide by what agency the fair plans and estimates would be prepared and the work carried out and decide what supervision if any would be necessary.

(10). If the district board staff is not considered competent to prepare the estimates for a large work it may direct that the Public Works Department prepare the estimates and the district board staff carry out the work under the supervision of the Public Works Department. These details can be settled once the main principles are accepted.

(11). In order to have a competent staff for supervision the Public Works Department would have to keep a certain number of provincial divisions at places where there are a large number of provincial works as at Allahabad, Benares, Agra, Lucknow, Naini Tal, etc. In small districts like Bahraich, Fatehpur, Partabgarh, Sultanpur, etc., provincial works can be made over to the local boards for maintenance, the provincial staff simply checking the estimates sent in and certifying the work is properly completed.

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(12). Similarly, in the case of municipal board engineers certain provincial roads within municipal limits could be made over to the municipal boards for upkeep and maintenance, the procedure to be adopted to be similar to that proposed for district board staff. The prospects of the municipal engineering staff should be improved in the same way as suggested for the district board staff and the relations of the municipal board engineers to the Sanitary Engineer's staff should be similar to the relations proposed between the local board staff and the Provincial Public Works Department. The details of these proposals could be easily worked out and a suitable cadre fixed for the provincial engineering establishment to carry out provincial works and supervise and advise on local and municipal works. This will be dealt with later, but whatever the agency employed all work should as far as possible be entrusted to recognised engineering firms as contractors in order to promote the growth of this desirable branch of the profession.

4,207. (III.) Changes in organization.—The changes recommended above would necessitate the following modifications in the organization of the staff of the Public Works Department.

(a). Recommendation made in (I). Executive divisions to be formed. Each Executive Engineer to have a personal assistant preferably an engineer. All payments to be made by the Executive Engineer or his personal assistant, all contracts to be given out by the Executive Engineer and all materials passed by him. Detailed projects to be prepared as far as possible in a central project office.

(b). District board engineers to be separately recruited. Big districts having experienced engineers in charge, second-class districts employing Assistant Engineers or senior upper subordinates.

(2). Either class of district can employ a firm of consulting engineers in lieu of an engineering staff. In the first-class districts employing senior engineers, or in districts employing a firm of consulting engineers, the work to be under the supervision of a Public Works Department Superintending Engineer. In smaller districts the work could be supervised by Executive Engineers. Provincial divisions would be kept up at large places where provincial Assistant and Executive Engineers could be trained. For municipal and sanitary work a separate branch under the Sanitary Engineer would be maintained. This would include experts in mechanical and electrical engineering, water-supply, drainage and town planning, and all problems connected with municipal administration.

4,208. (IV.) Relations with other departments and sub-branches.—The Public Works Department meets the needs of other departments of the administration as far as it is possible for a department organised on its present lines to do. Delays in the preparation and submission of estimates are sometimes complained of and this would be much reduced if a project circle were organised and the work of preparation of detailed designs and construction separated as far as possible. The relations *inter se* of the various subdivisions of the Buildings and Roads Branch, sanitary, architectural, electrical and civil engineering are on the whole satisfactory at present, but in view of the necessity of allowing for future growth and developments and greater specialization in the different branches some degree of decentralization is urgently necessary; these proposals are dealt with in detail under (V.)

4,209. (V.) Decentralization and (VI.) Simplification of procedure.—I am of opinion that the Buildings and Roads Branch as at present constituted might with advantage be split up into two branches, one dealing with buildings, roads, railways and local works and the second dealing with all problems connected with municipal and sanitary engineering, i.e., municipal drainage, sewerage, water-supply, electric lighting and town planning. My reasons for suggesting this is that the work in the Buildings and Roads Secretariat under the Chief Engineer is too heavy at present to allow of adequate time and attention being given to municipal and sanitary work.

The problems to be dealt with in municipal engineering are as distinct from those ordinarily dealt with by the Buildings and Roads Branch as they are from the problems met with in irrigation or railway engineering. If men are required to become experts in one particular line of engineering I am convinced that it will be better to separate the two branches and to make them distinct branches and the Sanitary Engineer head of a department for municipal and sanitary engineering.

(2). The reason why I have included electric lighting with the Sanitary Branch is that all problems relating to electrical schemes are for lighting in municipal limits, and all such schemes should include a day load for pumping and either water-supply or sewerage in the municipalities in these provinces if they are to be made financially successful. It is more than likely that the main power station and the workshops and staff would be common to all three schemes for lighting, water-supply and sewage pumping and the department which deals with drainage and water-supply and the plans and machinery connected with these should also deal with electric light and power schemes, and the men in this branch should be made to specialize in mechanical and electrical designs as well as in designs for drainage and water-supply schemes and ordinary municipal work. I would put architecture as part of the Buildings and Roads Branch which would include road and bridge engineering. The Chief Engineer's office would have attached to it a project circle, with an Architect in charge of building and other designs requiring architectural treatment and a civil engineering design branch for working out all engineering designs in consultation with the Architect for architectural works and with the Chief Engineer for purely engineering designs. The Consulting Architect to Government should rank as a Superintending Engineer with a suitable staff and his colleague, the consulting engineer for engineering designs, should be of equal rank. There may be three other Superintending Engineers for construction under the Chief Engineer. These Superintending Engineers may be classed as Deputy Chief Engineers and form part of the Chief Engineer's office, the same as Deputy Inspectors General of Police.

(3). The Sanitary Engineer should be head of a branch for sanitary and municipal engineering. This should form part of the Public Works Department. The staff of civil engineers under the Sanitary Engineer should be required to specialize in drainage and water-supply design and in the working out of electrical distribution schemes if necessary. They should also be familiar with the machinery used for pumping purposes or generating power.

(4). The staff should be on the permanent and pensionable list and it ought to be organised on the same lines as the Buildings and Roads and Irrigation Branches. The engineers should have similar qualifications and status. To meet any sudden rush of work a few temporary hands could be engaged from time to time and their services could be dispensed with when the rush was over but the present system of trying to run this branch with purely temporary men should be stopped. The Sanitary Engineer should have under him one or two Deputy Sanitary Engineers and a staff of Executive Engineers and Assistants. Well-boring operations for municipal water-supplies and town planning and improvement schemes should also be dealt with in the Sanitary Engineering Department.

(5). An Electrical Engineer with a staff of purely electrical Assistants to look after the construction, upkeep and running of electrical schemes under government or municipalities should be associated with him in the same manner as the Consulting Architect is associated with the Chief Engineer. There should also be a Chief Mechanical Engineer who would have all the purely mechanical staff engaged in the running and upkeep of the machinery under him. The Chief Mechanical Engineer and his staff would also work in conjunction with the Sanitary Engineer as part of his staff. All important work done by municipal engineers and all new project work or construction for water-supply, drainage or power-supply purposes and town improve-

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ment schemes should be under the professional supervision of the Sanitary Engineer.

(6). The Sanitary Engineer should rank as head of a department and where there is sufficient work he should be a Chief Engineer and Joint Secretary to Government in the Public Works Department. In smaller places he might work through one of the existing Secretaries but he should be finally responsible for all work in his department and should have access to the head of the province or Member in Council in charge of his department when necessary.

(7). There should also be a Sanitary Engineer to the Government of India. He would be an inspecting and advisory officer and would be most useful in co-ordinating work which was being done in different provinces and in giving advice when referred to by the provincial Administrations and in reporting generally on sanitary schemes throughout India. He would hold a similar position to the Sanitary Commissioner to the Government of India or the Inspector General of Irrigation with regard to the provincial officers in charge of these departments. The amount of work to be done in the Sanitary and Municipal Engineering Department is limited only by the amount of funds available and the trained staff necessary to carry out the work. There is no doubt that it is likely to expand greatly in the near future.

(8). The Public Works Department Code is on the whole very satisfactory and useful. There are two points on which the restrictions made hamper the execution of work.

(a). The restriction with regard to purchase of European stores in India.

(b). The necessity for spending sums allotted for particular works within the financial year and the lapsing of all sums so allotted at the end of a financial year if not completely utilized. Some alterations in these rules appear to be required.

4,270. (VII.) Education.—The system of education is not entirely satisfactory; a great deal of time is spent

in studying subjects which should be acquired before a student enters an engineering college, for instance chemistry, physics, dynamics, statics, differential and integral calculus and pure mathematics and elementary drawing. A student entering an engineering college, should know all this and should only require to be taught engineering chemistry or practical hydraulics, applied mechanics, civil engineering and survey and practical designing. At the end of an ordinary course there should be post-graduate courses in practical designing in say irrigation, railway work, sanitary work, drainage and water-supply schemes, electrical distribution and machinery.

4,271. (VIII.) Practical training.—On leaving the college every Assistant Engineer should be apprenticed in the branch in which he elects to serve for a period of not less than two years. He might be sent to one or other of the various branches:—railways, irrigation, buildings and roads, sanitary and municipal engineering.

(2). If necessary he might receive a stipend of Rs. 100 a month for the first year and Rs. 150 a month for the second year and Rs. 200 in the third year, if a third year is allowed. No direct appointment should be given but applications might be considered by a Board from men who have been through college and done a post-graduate course and two years' apprenticeship, or three years' apprenticeship without a post-graduate course, and selections made by a Board consisting of representative engineers from the Railway, Irrigation, Buildings and Roads and Sanitary Branches associated with one or two educational members and one or two unofficial members nominated or elected to the Board.

(3). Apprentices after having completed two or three years' practical training should get a certificate and some sort of degree equivalent to the A.M.I.C.E. and should then apply for posts under government or private bodies but should not be allowed to continue to serve in the Department to which they were posted for training but should make way for a new batch of apprentices.

Mr. C. H. West called and examined.

4,272. (President.) The witness stated that he was the Sanitary Engineer to the Government of the United Provinces and that he had held that appointment since 1911.

4,273. With regard to his qualifications for the post he stated that he had been employed in 1893 on sanitary work connected with drainage schemes at Hardwar and had also been connected with fire protection schemes. He had in addition studied drainage in several parts of England when he was on 7 months' furlough and read books on sanitary engineering. He had not, however, undertaken the actual construction of sanitary works in England.

4,274. He advocated the creation of a central office for the preparation of designs and estimates and was of opinion that it would lead to greater economy and efficiency. It was inadvisable to permit engineers to stay in the office he proposed permanently, as it was not a good principle for engineers to be employed for long periods only on designing, but there was no objection to their employment on such work for about three years. It was not a good principle for engineers to be employed solely in the districts without the opportunity of preparing designs and it was desirable that they should be posted to a designing office at some time during their careers so as to gain experience of both construction and designing work, as was the case in railways where designs were prepared in the office of the Chief Engineer, the designers being connected with the construction of the project. When he was Under Secretary, his duties included the checking of schemes which came up for approval, and he had found that half-a-dozen designs had been prepared for schemes for which one design would have sufficed. He therefore considered that a portion of the proposed central office work should consist of the preparation of standard plans. Difficulty would not be experienced in the preparation of designs and estimates without any local knowledge of the site,

materials, etc., as those which concerned districts would be "preliminary projects" and would be accompanied with suggestions as to how such projects should be executed. He added that the preparation of all designs should not be dealt with in the central office he had proposed, but only those relating to important works.

4,275. By the words 'construction division' in his written evidence, he meant a division practically wholly engaged on the execution of work. In other words, an Executive Engineer's division *minus* the preparation of designs.

4,276. He suggested the re-introduction of the system under which private engineers were employed under local boards, that is, that district engineers should be brought into line with the district administration and made subject to the orders of the civil authorities. His proposal would not involve much change in the present system under which the district engineer was subject to the orders of the Executive Engineer, and he was of opinion that the district engineer should be an employee of the district board.

4,277. He was also in favour of the creation of an inspecting or provincial staff for the supervision of works handed over to district boards, and considered that the Public Works Department should retain a certain number of provincial divisions at places where there were a large number of provincial works, in order to allow for their recruitment, provincial works in small places being handed over to the boards. He added that it would be possible by this method to recruit officers for the higher posts, and for the district boards to select their district engineers from the provincial staff if necessary.

4,278. The introduction of Deputy Chief Engineers in place of the present Superintending Engineers who, instead of maintaining a separate office, would employ only a camp clerk and form part of the office of the Chief Engineer to whom they would act more or less as personal assistants, was also desirable. One of the

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advantages in the adoption of such a system would be the abolition of the large office establishment of the Superintending Engineer. Moreover, cases would be noted on by the Deputy Chief Engineer and sent direct to the Chief Engineer whereas, under the present system, they had to pass through the hands of both the Executive and Superintending Engineers and the personal assistant before they reached the Chief Engineer, thus resulting in the waste of a good deal of time. Each Deputy Chief Engineer would act as personal assistant for his circle and would form part of the administrative or direction staff of such circle on the analogy of the Police Department in which the Inspector-General and Deputy Inspector-General did not maintain separate offices. There was no necessity for the maintenance of a separate office for the Deputy Chief Engineer, and, from his experience in the Chief Engineer's office, he was of opinion that the system he advocated would work satisfactorily.

4,279. The entire separation of the Sanitary Branch from the Chief Engineer was further desirable as that officer was already overburdened with work. It was true a certain amount of advantage was gained by the scrutiny of sanitary projects by the Chief Engineer provided that officer had sufficient time at his disposal, but it was not commensurate with the time required in this connection. Apart from this, the Sanitary Engineer should be responsible for the construction of all projects he put forward, and such responsibility should be shifted from the shoulders of the Chief Engineer, as sanitary problems differed considerably from the ordinary problems with which that officer had to deal.

4,280. The creation of a separate construction staff for sanitary engineering works was necessary as it was not a sound principle to employ men only on the drawing up of projects and not to give them construction experience; it was not satisfactory either from the designer's or engineer's point of view. Under his proposal a man could with advantage be employed on the construction of sanitary work after spending some time in the office of the Sanitary Engineer. The objection to the alternative system of employing the engineer on the construction of projects designed in the Sanitary Engineer's office was that it would deprive men engaged on the designing of projects of the chance of gaining actual experience of construction work unless the transfer of such officers could be effected. If detailed plans and specifications for sanitary work were drawn up, the Executive Engineer could carry out construction, except in cases in which a change of design was necessary, which latter occurred frequently.

4,281. With regard to the contention that as sanitary projects in particular were constructed so irregularly it would be difficult to maintain a permanent staff for them, for instance, that at one time there might be a dozen sanitary projects in progress in a province whereas at other times there might be none, he explained that until recently the province had had a very small sanitary budget of only Rs. 5 lakhs. This, however, had steadily increased, the budget for 1915 having been Rs. 19 lakhs and for 1916 Rs. 23½ lakhs. The expenditure was still on the increase and the whole question was one of finance, but demands for projects were always being received. He added that the local Government made a recurring grant of Rs. 5 lakhs a year, the Government of India giving a similar amount in addition to a special grant, and that the municipal loans amounted to Rs. 16 lakhs a year; sanitary expenditure therefore was on the ascendancy and it would double itself within the next 10 or 15 years.

4,282. District boards and municipalities were not under any obligation to employ the Sanitary Engineer for the drawing up of their projects, as the rules in this connection laid down that they could either employ that officer, their own engineer, a company or any suitable agency, and they had as a matter of fact employed private firms, one of which had carried out several projects. The procedure followed in this connection was that they voluntarily indicated the agency they desired to employ for the construction of particular works to the Sanitary

Board who, if the agency was considered suitable, gave administrative sanction to the preparation of the project. It was not the case that the government grant was dependent on the preparation of the projects by the Sanitary Engineer, and if local boards desired a government grant for the construction of a particular work, they would not obtain such grant more readily by the employment of the Sanitary Engineer on the preparation of the project, as the grant was dependent only upon the project having been properly prepared. As a matter of fact, some large grants had recently been made to the Lucknow and Benares municipalities for works the designs of which had not been prepared by the Sanitary Engineer.

4,283. In connection with the change of policy in regard to the construction of sanitary works, he explained that there had formerly been very little money available for sanitary works and that the Sanitary Engineer then possessed a small staff. A sanitary engineering firm therefore prepared all drainage schemes, the Sanitary Engineer being responsible for the preparation of water-works schemes. Several municipalities were in this way furnished with drainage schemes by the firm in question at a cost of Rs. 6,000 to Rs. 9,000 each and such schemes, when examined, were found to be unsatisfactory with the result that practically all of them had to be either partially or entirely revised. These schemes, when accepted in the first instance were not incorrectly prepared, but they had been drawn up on lines which were not the best. The Sanitary Engineer was not in touch with them at the time of their preparation as they were left entirely in the hands of the firm in question, hence he was not able to pronounce a professional opinion on them at the initial stage. The system had in the circumstances been changed with the increase in the sanitary staff, and the Sanitary Branch now drew up its own projects. If the firm could draw up sanitary schemes satisfactorily they would undoubtedly be accepted.

4,284. He advocated the appointment of a mechanical engineer for the supervision of expenditure on the upkeep of machinery. The province was at present spending about Rs. 7 or 8 lakhs a year on the maintenance of water-works. These were under his supervision, and this meant that municipal budgets of expenditure and maintenance of water-works, the monthly records of coal consumption, pumping and filtering were for professional purposes all subject to his scrutiny. The sanitary staff of municipalities was selected by those bodies subject to the approval of the Chief Engineer. This staff was at present under the orders of the municipalities for all ordinary purposes, but a check had to be kept by the Sanitary Engineer on the engines to ascertain how much water had been pumped and what horse-power had been developed, etc., and if anything went wrong with the machinery he had to arrange to remedy the defect, there being no one on the municipal boards who was capable of doing it. He was therefore of opinion that the sanitary staff of municipalities should be directly under the orders of the Sanitary Engineer, since, when any question arose in connection with maintenance or repair of water-works, he was required to advise them on the matter. He thus really possessed advisory functions in connection with the sanitary work of municipalities as the whole management of such was in his hands. He could not dismiss a member of a municipal sanitary staff, but could send in a report in this connection. The members of municipal boards as a rule did not possess any knowledge of sanitary engineering work and hence they had no desire to work independently of the Sanitary Engineer. On the contrary, they were keen on their sanitary work being undertaken by that officer.

4,285. Municipal sanitary works were ordinarily constructed under the supervision of the Sanitary Engineer at a charge of 2 per cent., but their water-works were supervised free of charge. The pay of the mechanical engineer he had advocated should therefore be based with reference also to the expenditure incurred on the maintenance of water-works.

4,286. (Sir Noel Kershaw.) The Buildings and Roads Branch of the Public Works Department might be divided

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[Continued.]

into two branches, one dealing with buildings, roads, railways and local works, and the other with all problems connected with municipal and sanitary engineering, that is, municipal drainage, sewerage, water-supply and electric lighting. Roads should be placed under the first branch as the Sanitary Engineer was only connected with sanitary schemes or roads within municipal limits, the roads outside such limits being under the control of the district boards concerned.

4,287. Municipalities did not object to pay for the supervision of their water-works, but the Sanitary Engineer had up-to-date employed such a small staff that he would not have been justified in asking such bodies to pay for such supervision. A proposal had recently been referred to certain municipalities regarding the appointment of a mechanical Sanitary Engineer for the whole province, and the majority of them had agreed to it.

4,288. The sanitary schemes prepared by the sanitary engineering firm previously mentioned were not up-to-date. Moreover, flushing tanks had not been properly provided and sewers had been laid down at unsatisfactory gradients.

4,289. (Rai Bahadur Ganga Ram.) He had been recruited from Roorkhee. He had been to England on two occasions and had studied sanitary engineering while there. In addition he had been employed in checking sanitary projects when Under-Secretary to the Public Works Department of the local Government.

4,290. He ranked as a Superintending Engineer and was at present entitled to that rank by virtue of his seniority. He was not the senior Executive Engineer when he was appointed to his present post, and superseded several officers as he was considered the best fitted for the post.

4,291. He was entitled to move to the hills during the hot weather but had to tour for about eight or nine months of the year. He had suggested to government that a drawing office for sanitary work might be located in Naini Tal and that the Sanitary Engineer should spend the whole of the winter and part of the rainy season and hot weather in touring.

4,292. The sanitary schemes prepared by the sanitary firm already referred to were generally prepared on lines which were not quite satisfactory, and mistakes in levelling had occasionally occurred. It was not the case that such schemes were subject to the whims of the Sanitary Engineer. The firm, moreover, did not resort to sewerage sufficiently and the engineering aspect of the schemes was defective—drains being 'V' shaped. The substitution of sewers for surface drains generally resulted in a slight increase of expenditure, but the difference was slight.

4,293. The Sanitary Engineering Branch should eventually be entirely independent of the Chief Engineer.

4,294. He had on one occasion been called from Naini Tal in connection with the breakdown of two water-supply engines in Allahabad. This was due to carelessness on the part of the staff and had resulted in the water-supply of the town being out off for a time.

4,295. (Mr. Willmott.) The sanitary engineering firm he had referred to did not claim to be water-works engineers, but the chief reason why it was not at present employed by government was probably because it resented criticism and its work was not entirely of a satisfactory nature.

4,296. The charges for the employment of the temporary sanitary engineering staff on projects and works were recovered from municipalities in the shape of fees. No charges were, however, made in respect of direction establishment.

4,297. Municipalities were charged 2 per cent. for the preparation of projects and 12 per cent. for the construction of works by the sanitary engineering staff.

4,298. He was in favour of the creation of a Local Government Board, similar to the Sanitary Board, for the examination of district board projects.

4,299. The designing office he had suggested should undertake only the designing of major building and road projects. In addition it should be an information bureau for the collection of facts of interest and the carrying out of investigations and the testing of materials. Information in connection with specifications could also be collected by the office, and Apprentice Engineers trained in it in collaboration with the Consulting Architect.

4,300. If Deputy Chief Engineers were substituted for Superintending Engineers, the former being transferred to the central office, a great deal of unnecessary correspondence would be saved. They would perhaps not be very much in touch with the central designing office, but Superintending Engineers at present did not undertake much actual drawing work. The system he had proposed, would result in a considerable saving of office staff.

4,301. One of the restrictions in the Public Works Department Code which hampered the execution of work was the necessity of spending sums allotted for particular works within the financial year, and the lapse of all sums at the end of the financial year as were not completely utilized. He thought this could be remedied by the allotment of money for works on the understanding that no portion of it would lapse before the completion of the works.

4,302. Assistant Engineers after leaving college should be apprenticed to the branch in which they elected to serve and receive a stipend of Rs. 100 a month to commence with. He employed six Apprentice Engineers at present and received value for the money he paid to them as they helped in the drawing up of projects and in the construction of work. The system he had proposed would not interfere with recruitment.

The HON'BLE MR. W. S. MARRIS, C.I.E., I.C.S., Inspector General of Police, United Provinces.

Written Statement.

4,303. (L.) Economy and suitability of methods of execution of public works, (II.) Encouragement of other agency, and (IV.) Relations with other departments and sub-branches.—I have consulted a few selected officers. As regards para. 2 (ii) of the Government of India Resolution 90-F.A., dated November 24th, 1916, they are generally of opinion that private enterprise is not sufficiently encouraged by the present system. The Public Works Department no doubt makes extensive use of contractors; but contractors are believed to be too dependent on the Department and particularly on subordinates of the Department, to develop as they would do if departments requiring buildings dealt straight with them. I agree that it would be both possible and desirable to dispense very largely with the Public Works Department for police purposes, but before making specific proposals, I will deal briefly with existing difficulties and drawbacks. This will cover the ground of the further question in paragraph 2 (iv) so far as the Police Department is concerned.

(2). So far as larger works, i.e., those over Rs. 2,500 are concerned, the main objections to the existing system are (a) the expensiveness of Public Works Department charges (b) the delays in execution. In the case of minor works there is the difficulty that the police officer responsible for a work may have no particular knowledge of materials or construction; and in that case, unless he is fortunate enough to have a Reserve Inspector who is better equipped in this respect than himself, he will have to rely on the good offices of the local Public Works Department officer which he cannot formally requisition, or possibly pay a consulting fee to some municipal engineer. The chief trouble however arises over major works. The Department is very badly off for buildings and could probably spend something approaching Rs. 100 lakhs if it had it in putting its offices, stations, lines, hospitals and *chaukis* into proper condition. Men and officers are at present very ill housed and the question from the point of view of efficiency is a serious one. The Public Works Department budget provision for police buildings has lately been only about Rs. 1½ lakhs a year; and progress

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which would in any case be slow has further been retarded not merely by the high rates charged, but by delays in execution which result in large sums lapsing every year. A further defect for which the Public Works Department is not responsible is that the Police Department has hitherto lacked a complete survey of its building requirements. No ordered programme has been drawn up and the result is that projects are selected in a haphazard fashion. The order of execution depends on the insistence of local officers, the expedition or delay with which projects are received, and the degree of financial stringency, and probably does not correspond at all closely with the real order of urgency. Further, though there are standard plans for buildings of most types it is not certain that these are of the best type possible; and there are not in existence standard plans for the various classes (1st, 2nd, 3rd class lines, offices, or stations) as there should be.

(3). Police work is not like education, capable of indefinite territorial expansion; and the problem of housing the police properly is a perfectly finite one which could be dealt with in say 15 years if money were forthcoming. The first thing seems to be to make a complete survey of our needs, and to determine an order of urgency which is not to be departed from except when this is inevitable as when buildings collapse wholly by reason of rain or flood. Buildings should then be classified in three classes:—

A.—Important works. These would include lines, large offices, large *kotwalis* and Superintendent of Police's residences in large places.

B.—Middle class works including smaller lines, all *thanas* and quarters.

C.—Outposts, additions to existing buildings and the like.

MR. H. WILLIAMSON, Assistant to Inspector General of Police, United Provinces, called and examined.

4,304. (President.) The witness stated that he was a member of the Indian Police force. He was also Assistant to the Inspector General of Police, United Provinces, and in his capacity as such represented the views of the latter officer in regard to police buildings.

4,305. Under the existing system, the Police Department executed repairs to its own buildings other than residential. The Police Department also constructed buildings to the value of Rs. 2,500, and those costing more than that sum were entrusted to the Public Works Department.

4,306. The Inspector General had outlined a scheme in his written statement for doing without the agency of the Public Works Department in the matter of the construction and repair of police buildings. If it were urged in other provinces that the main objection to the scheme was that it had been found in practice to cause a great deal of interference with an officer's legitimate duties, this did not apply to the United Provinces as the police had sufficient leisure to undertake building operations provided they did not require special technical skill. The insufficiency of accommodation at present provided for the police in the province was a serious defect and it affected the discipline and standard of police work, and it was as much the duty of the Superintendent of Police to see that his men were properly housed as to control other branches of his work. The Police Department could profitably utilize grants for buildings without the intervention of the Public Works Department. It was true that they possessed no professional knowledge in connection with building work, but the Inspector General had suggested the loan of the services of an advisory officer from the Public Works Department to remedy this. The contention that the proposed system was open to abuse and the making of an improper demand on *zemindars* for labour, materials and other requirements was hardly valid. Such measures had not been resorted to in connection with the construction of buildings by the Police Department which cost less than Rs. 2,500, at any rate no complaints had reached the Inspector General.

(4). For A, tenders would be invited from well established firms of repute and they would be given a building programme extending over a series of years which would make it worth their while to undertake the work. Standard plans would be supplied to them, but as circumstances required they would modify or adapt these with the approval of the Department. The tenders would be referred to a consulting engineer of the Public Works Department for advice; but there would be no supervision of materials or construction by the Public Works Department. The reputation of the firm would be the guarantee for good work.

(5). For B works, Superintendents of Police should be authorised to employ local contractors. It is believed that these will be forthcoming in sufficient number and quality. But as the works are of considerable value, the Police Department must have competent engineering advice available to check the work. There should be a Public Works Department officer of standing told off as consulting engineer for the department. He would check plans and estimates, and visit and inspect all works under construction. If there were not enough work to keep him fully occupied, he could fill the same position for another department too; but for some time to come he could be usefully employed in constructing the building programme to which I have referred.

(6). C works would remain under the agency of the Police Department and I think the limit of expense might be raised to Rs. 5,000. But the need for expert advice exists here also. I would prefer that this should be forthcoming in the Police Department itself; I would attach or depute to it a small body of junior engineers who would have no concern with the letting of contracts but would tour in districts and inspect the work being done. They would be under the orders of the Inspector-General and responsible to him only.

4,307. He had not made a detailed comparison between the cost of buildings constructed by the Police and Public Works Departments respectively, but the Police Department certainly constructed its buildings cheaper than the Public Works Department. His authority for this statement was his 12 years' experience as a Superintendent of Police. He had besides had estimates framed by an officer of the Public Works Department, and constructed the buildings subsequently through the agency of contractors and found the rates considerably less. No professional man, as far as he was aware, had actually made a comparison of the two rates. He added that his views were also supported by several Superintendents of Police whom the Inspector General had consulted on the subject.

4,308. No definite programme of works showing the order in which work should be undertaken had hitherto been drawn up. The fault as a matter of fact was one of the Police Department. The question whether a building had to be constructed or not depended more on the strength of the recommendations of particular officers than on the real requirements of the department. It was actually decided by the Inspector General, but that officer was largely influenced by the demand of Superintendents in deciding as to the order or urgency of works.

4,309. The standard plans for buildings for Indian officers were not up-to-date as the class of such officers had altered. The social status of the *thanadar* for instance was higher than formerly and the old standard plans for that officer was accordingly out of date. As far as he was aware no suggestion for the revision of these standard plans had been made since 1911, and the adoption of the suggestion of the Inspector General to throw open the preparation of standard plans of all classes of buildings to public competition would result in the preparation of better plans than could be secured under the present system.

4,310. Class A works consisted of large works and the Inspector General had recommended that these should be constructed by contractors without any super-

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vision whatever, the good name of the firm being the guarantee for the quality of the work. The question whether such contractors could be obtained was one which depended largely on the grants available. The underlying idea was to draw up a programme of about Rs. 100 lakhs and to extend it over a series of years, limiting the construction of a certain number of buildings to a specified number of years, and he anticipated that firms would be prepared to take over the entire work contained in it. The middle class buildings would be constructed by the Police Department through the agency of local contractors subject to the supervision of an officer of the Public Works Department. It had been proposed that that officer should be an engineer specially deputed by the Public Works Department to act as consulting engineer to the Police Department and to inspect the building operations scattered over 16 districts. His duties would not be very heavy as judging from the present rate at which money was obtained the number of buildings under construction could not be very great. No scheme was in contemplation under which a large sum of money would be spent on the construction of buildings in one district. In addition to this engineer it was proposed to employ a certain number (about three) of junior engineers of the Public Works Department who would rank either as Assistant Engineers or upper subordinates, to ensure the maintenance of efficient supervision over works, and such officers would act as technical advisers to the Police Department.

4,311. (Mr. Cobb.) The Inspector General was influenced, in connection with the construction of police buildings, by a Superintendent insisting that his men had the prior claim, and this really amounted to an officer making out a better case for his own particular buildings than that made out by another officer.

4,312. (Rai Bahadur Ganga Ram.) He believed that the standard plans of the Police Department had been

prepared between 1910 and 1911. He had not compared them with the standard plans of police buildings in other provinces but admitted that such a comparison might have proved useful. The drawing up of standard plans by public competition would lead to an improvement in the design of buildings and the provision of better accommodation as well as a saving in expenditure. The repairs executed at present were checked by circle inspectors and Superintendents, but such officers could not check quantities.

4,313. (Mr. Willmott.) The police works he had himself seen were mostly *kutcha* buildings, and he had had no long experience of their durability and the cost of their maintenance. The maintenance charges of *kutcha* buildings would, he thought, be comparatively heavy.

4,314. He did not think any attempt had recently been made to revise the standard plans.

4,315. The Inspector General presumed that reliable firms in Calcutta and other places would undertake the construction of police buildings only within a 20 or 30 miles radius from district headquarters.

4,316. For the supervision of the class B buildings the Inspector General had in mind an officer of the rank of Executive Engineer. An extended programme would be necessary to justify the employment of such an officer, but the Police Department hoped to be in a position to dispense with his services after a period of 10 or 15 years.

4,317. He did not think that police buildings were of such a complicated type as to warrant the engagement of a specialist solely for their design, but there had been a lack of personal interest in the matter on the part of the officers of the Police Department. The inspections of the proposed consulting engineer would entail a certain amount of overlapping; that, however, could easily be adjusted.

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MR. A. R. ASTBURY.

[Continued.]

At Lahore, Saturday, 7th April 1917.

PRESENT.

F. G. SLY, Esq., C.S.I., I.C.S. (President.)

SIR NOEL KERSHAW, K.C.B.

G. S. COBB, Esq., M.V.O.

RAI BAHADUR HANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

D. W. AIKMAN, Esq., C.I.E., Chief Engineer and Secretary to the Government of the Punjab, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary.)

A. R. ASTBURY, Esq., A.M.I.C.E., Sanitary Engineer to the Government of the Punjab.

Written Statement.

4,318. In this memorandum I have, for convenience of treatment separated into six parts the subject matter of paragraph 1 of Government of India Resolution No. 66 E.A., dated 24th November 1916—

(i) to discover if, and how, the Buildings and Roads Branch can be made more economical and efficient;

(ii) the opinion that the changing conditions of India render it desirable to secure the execution of public works by private agency rather than departmental agency;

(iii) the opinion that, apart from political considerations, it would be a state economy to use either a private agency or a local body;

(iv) the opinion that simple unimportant works now undertaken and supervised by highly salaried officers of government could be carried out cheaper by contract under government inspection;

(v) the argument that if local bodies are encouraged and enabled to arrange more extensively than at present for the execution by their own staff or by private agency of their works, it will not only be a further step in the direction of decentralization, but also would stimulate the growth of firms of standing in the building and allied trades and so encourage further industrial activity;

(vi) the proposal to equip the engineering colleges for training men to become engineers capable of being successful as consulting engineers in private practice.

If the opinions (ii) to (iv) above are sound and are carried to their logical conclusion, the Buildings and Roads Branch of the Public Works Department as an agency for the execution of work will cease to exist. Before discussing the merits of the opinions (ii) to (iv) the possibility of doing without the Buildings and Roads Branch will be examined assuming that the composite substitute—private agencies, local bodies and "contract under Government inspection"—has been called into being. The matter will here be considered only from the point of view of the local Government of the Punjab.

4,319. The Buildings and Roads Branch at the present time is responsible for the construction and maintenance of—

(a) the major lines of road communication, including the bridges, fixed and floating;

(b) the buildings required for the machinery of government in the provincial civil administration, justice, police, jail, revenue, agricultural, etc.;

(c) the buildings required for the machinery of government in the imperial civil administration, posts, telegraphs, etc.;

(d) residences of government officials;

(e) churches and cemeteries.

The Buildings and Roads Branch act as consulting engineers to local bodies and the local Government has laid down monetary limits beyond which local bodies may not proceed without the advice of Public Works Department officers.

(2). The Sanitary Branch of the Public Works Department is almost entirely occupied in work for local bodies.

(3). Certain Acts require the performance of duties by Public Works Department officers, such as the Boiler Act, and the Electricity Act, while other Acts would be difficult to work unless the local Government could call in the assistance of their Public Works Department: these are the Municipal Act, the District Board Act, the Ancient Monuments Preservation Act. Among the agencies which it is proposed to substitute for the Buildings and Roads Branch is "contract under Government inspection." This implies that although the Buildings and Roads Branch may be abolished as an executive body, yet certain Public Works Department officers will be retained by government for the inspection of works done by contract. Presumably among the officers thus retained would be included those whose duties are at present mainly inspectorial or advisory. These are the Sanitary Engineer, the Electrical Inspector and the Boiler Inspector. For the inspection of works done by contract and as advisers to local bodies the local Government would retain a staff of inspecting engineers. An administrative head would also be required with a Secretariat staff. The Buildings and Roads Branch would thus become a non-executive body having only administrative, inspectorial, and advisory duties.

(4). At present the "advice" given to local bodies commonly takes the eminently practical form of working out complete projects for them, and if necessary of carrying out the work itself. Following the principles advocated in (ii) to (iv) the advice finally would be limited to opinions on projects prepared by private agencies or the local bodies. In short the position of the Buildings and Roads Branch would become similar to what I understand to be that of the Local Government Board in England.

(5). The question may be re-stated thus—Can the requirements of the local Government in the matter of public works and local Acts be met satisfactorily by a Buildings and Roads Branch constituted on lines similar to those of the English Local Government Board, provided that competent private agencies and local bodies employing "a skilled public works agency" exist?

(6). I am of opinion that an affirmative answer can be given to this question except with regard to (a) "the major lines of road communication." Here the importance of direct state control is obvious for political, military and commercial reasons. The maintenance might, however, be transferred from the Buildings and Roads Branch to the Military Works Services. Until, however, the competent private agencies and local bodies possessing "a skilled public works agency" do exist, a decided negative answer must be given. It is obvious that these agencies will not spring suddenly into existence, and that there will be a transition period during which they will be incubated and reared. It seems probable that in this province the transition period will be of considerable duration, probably not less than a generation of thirty years. In such case any efforts in thinking out improvements to the Buildings and Roads

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Branch will not be wasted as the executive machine cannot be scrapped for some time to come.

4.320. *How the Buildings and Roads Branch can be made more economical and efficient.*

Sanitary Branch.—In the Punjab the demand for sanitation is rapidly growing. The devastations of malaria, plague, cholera, dysentery and tuberculosis and the high incidence of infantile mortality, combine to give the Punjab a very heavy death-rate. Prejudices against piped water-supplies are disappearing, and even the poorest people understand the advantages of a paved and drained alley-way over wading ankle deep in slush. Town planning is forcing its way to the front and the Punjab can already show improvement to streets and markets which are financially successful as well as hygienic.

(2). Simla possesses a completely motorized water-supply, a high pressure fire service, and sewerage system with purification works. Lahore is contemplating a sewerage system on a large scale, and a considerable increase to the water-supply. Amritsar had made the first steps in a sewerage system. Sialkot has a new water-supply drawn from tube wells, and other towns are following suit. In Lahore, pending the advent of its sewerage system there are three institutional sewerage purification works.

(3). It will be readily understood from this brief statement that the scope for the Sanitary Engineer in this province is very wide. Town planning is bringing in its train a demand for sanitary dwellings, improved markets, bathing places, washing ghats, slaughter houses, and the Sanitary Engineer is called in to furnish designs for all such. To meet this growing demand it is necessary to expand the Sanitary Branch of the Public Works Department.

(4). At present there is the Sanitary Engineer, his personal assistant, a sanitary sub-division, a head surveyor and a small drawing and office staff. The volume of work dealt with is such that it is impossible for the fullest consideration to be given to all the projects which pass through the office.

(5). I am of opinion that the Sanitary Branch should be strengthened—

(i). By the addition to it of one European officer who has been specially trained in sanitary engineering and has had not less than five years' practical experience of his profession in England. This officer should be between 26 and 32 years of age, and should be engaged on a five years' covenant. He would be styled the Assistant Sanitary Engineer, and would be employed under the Sanitary Engineer on the design and construction of sanitary works. For the first six months he would visit and study the sanitary works of the province and learn the language.

(ii). By the formation of a water-works sub-division with the headquarters at Lahore for the regular inspection of the many municipal water-works in the province. The maintenance of water-works is at present in a most haphazard condition. There are no systematic analyses. The routine of filtration work is left to untrained staff, and control is extremely lax. The water-works of first-class municipalities are usually under the control of qualified engineers, but in the smaller municipalities this is not so and quality and quantity of water delivered to the consumer are both much below the standards that might be attained with closer supervision. In a recent instance a Commissioner has suggested that the water-works of a second-class municipality be taken over entirely by the Public Works Department as the municipal control is so weak. I would lay down that it is in no way derogatory to the principles of local self-government for the provincial government to provide a local body with technical services which in their particular state of progress they may need. In fact, I would urge that local self-government would stand a better chance of success if it were not overloaded in its early days with the care of sanitary services which have arisen not from a demand for them by the people but have been partly presented to them and partly persuaded on them by government. In three instances during the past cold weather Deputy Commissioners have told me that they needed more assistance from government in the matter of sanitary

and public works, and that whereas in other departments of the administration they could manage with less interference, in public works affairs they were entrusted with the execution of works for which they possess neither the knowledge nor the inclination. Hence to meet the needs of the local Government I consider the Sanitary Branch of the Public Works Department needs strengthening in order to cope successfully with the increasing volume and complexity of the work it is called upon to undertake.

(6). *General.*—It would save the Public Works Department establishment much time and labour if the local contractors were able and willing to take a greater share of the accounts work. At present owing to the low standard of education, both literary and technical, among local contractors, the Public Works Department establishment are obliged to do a great deal of the work which in England the contractor does as a matter of course. Examples will now be given.

(7). *Calling for tenders.*—In England it is usual to call for tenders on the basis of bills of quantities, plans, and specifications, but in the Punjab the rates also are included and the contractor tenders at a percentage above or below the whole of the rates scheduled. If rates were not scheduled the local contractors would be liable to tender at all manner of ridiculous rates as they are not in the habit of keeping careful accounts of past works and have no trade journals or published price books to which they can refer. However a beginning might well be made and Executive Engineers might be advised to call for tenders for small works to commence with, omitting the schedule of rates, and in this way contractors would gradually accustom themselves to this method. The logical conclusion aimed at is, of course, to render unnecessary on the part of the Public Works Department—

(a) the preparation of divisional schedules of rates, with analyses, etc;

(b) the inclusion of estimated and calculated rates in the register of works.

For minor works contractors might be asked to submit tenders merely on the basis of plans and specifications, that is, they would submit their own quantities and rates.

(8). *Submission of bills.*—At present all contractors' bills are prepared by the Public Works Department, although the standard contract agreement mentions particularly that the contractor should do so. Again, commencing with small works, contractors might be encouraged who undertake to prepare their own bills of quantities.

(9). If government would lay down a policy of progress on these lines I think a body of contractors would gradually come into being capable of undertaking works in the English fashion instead of remaining, as at present, mere procurers of labour and dependent on the Public Works Department for all measurements, bills, tools and plant, stores and technical knowledge.

(10). The departmental accounts are at present burdensome. When the Public Works Department audit was abolished a few years ago in favour of the independent civil audit paid from imperial revenues, the changes necessarily involved were, unfortunately, not well considered beforehand. The old Public Works Department procedure in regard to establishment payments was modified and unnecessary complications were introduced; in course of time the worst features have been removed, but a good deal remains to be done. A committee of Public Works Department officers was convened at Lahore in 1915 and issued a report covering the proposals of the Comptroller-General; no orders appear to have been passed on the subject and the changes in procedure are still in a sort of half-fledged state. This, however, relates only to establishment payments and another proposal is also under consideration with the object of accelerating the audit to bring the Public Works Department accounts in final shape into those of the Indian Empire one month earlier than at present. In this connection it would save the Executive Engineer labour and also a feeling of uncertain responsibility if he could be relieved of all work connected with

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the compilation of the monthly divisional accounts in the several forms required for Imperial purposes, and the divisional accountant made solely responsible for this compilation work.

(11). At present the register of works is kept by the sub-heads of the sanctioned estimate for all major works, i.e., those estimated to cost Rs. 5,000 and over. I think the limit might be raised to Rs. 10,000. At present sub-heads under Rs. 500 are not accounted for separately, but are included under one head "items under 500 rupees." This limit might be raised to Rs. 1,000.

(12). When accounts are kept by sub-heads the rules prescribe that rates shall be struck monthly in order to compare the rate at which work is being executed with the estimated rate. In the case of works executed by contract for complete sub-heads of work this striking of rates in the works abstract serves no useful purpose and should be dispensed with. In fact, it might be dispensed with in all cases as its utility is very doubtful while it involves a good deal of arithmetical labour.

(13). I think it would be an improvement to introduce a new class of upper subordinates styled quantity surveyors. These men would be employed solely on the estimating and measuring up of large works. The subject is a difficult one, and not adequately understood by the ordinary run of subordinates.

(14). I think the Department would benefit by recruiting their engineers from England with not less than three years' practical experience in England, and giving them a starting pay to correspond with their period of practical experience. The object in this suggestion is to secure men who know how work is done elsewhere, and who can import into India ideas gained from practical experience and not be merely men raw from college. Such men should reach executive rank in a proportionately reduced period of time.

(15). Officers should be more frequently deputed by the local Government to visit works in other parts of India to learn what is being done elsewhere.

4,321. (ii). *The policy of substituting private agency for state agency in Buildings and Roads Branch duties.*—The policy to be pursued must be in conformity with the general policy of government of developing India on industrial lines. Industry and private enterprise being indissoluble the abolition of the executive portions of the Buildings and Roads Branch will aid in a small way the general policy.

4,322. (iii). *The economy in using a private agency or a local body.*—This point has been dealt with quantitatively in the memorandum of the Punjab Government, and I will confine my remarks to other issues.

(2). Entrusting government works to local bodies is contrary to the first principle of local self-government which aims at giving local bodies the care of such local affairs as they directly pay for. If the time of the staff of the local bodies is occupied in attending to the affairs which are not essentially of local interest, the staff is being taken from its legitimate duties. But apart from any political considerations government has had object lessons time and again to show that public works deteriorate when handed over to local bodies. Their standard is lower, their qualifications are lower, their morale is lower. In my opinion it is wrong both in principle and practice to hand over government works to local bodies either for construction or maintenance.

(3). Taking my own branch of the profession. The reviews of the local Government of the annual Administration Reports of municipalities contain ample evidence to show that local bodies have at present but little sense of civil duties, and that in particular their management of drainage works has been disgraceful, and has in many instances converted sanitary improvements into positive disease centres. * *This is no new feature will be understood from the following remarks copied from the Report on the sanitary administration of the Punjab for 1894, paragraph 57, "..... in many*

instances which have come under my own observation their (i.e., the municipalities) efforts in the direction of drainage and so-called sanitary improvements are misdirected and the money so spent totally wasted

The second-class municipalities usually cannot afford to entertain an engineering staff competent to undertake the execution of their large works, which of course only occasionally arise. Government recognises this and retains the services of the Sanitary Engineer and his staff for the purpose and permits the Public Works Executive Engineers to carry out on behalf of the local bodies these larger works. I think local bodies would be placed in great difficulties for the proper execution of their sanitary schemes if they are deprived of government agency before private enterprise is abundantly available. I am aware that there is at least one firm in Upper India of consulting engineers who are prepared to design, and arrange for the execution of sanitary works, for a percentage on the actual expenditure. Commonly the percentage, for execution only, is 17 per cent. Here a practical difficulty arises. The consulting engineers do not usually call for tenders and make out a regular contract agreement between one contractor and the local body for the entire work, but they arrange for its execution partly by the employment of a number of petty contractors, partly by buying imported stores themselves, partly by preparing local stores (such as lime, tiles, etc.) themselves, and they also buy on behalf of the local body the tools and plant required for the work. On all these heads the charge of 17 per cent. is levied. The consulting engineers thus do not occupy a definite clear cut position as in England, but stand midway between a consulting engineer and a contractor. The position is not satisfactory or businesslike as the local body has no definite contract agreement to rely upon, and the ordinarily well defined relations between contractor and consulting engineer are confused. Moreover, there is no inducement to economy, the accounts are subdivided unduly and difficult to trace easily. I cannot think that this system is a sound one.

4,323. (iv). *Using "contracts under Government inspection" for simple unimportant works.*—Nearly all simple and unimportant works are at the present time carried out by contract under government inspection. It is misleading to say that they are undertaken and supervised by highly salaried officers. The Executive Engineer does not personally engage coolies and mistris, buy brushes and white-wash, and set forth with tape and umbrella to supervise the repairs to a dāk bungalow. The work is usually part of a contract for repairs to a set of government buildings, and is probably inspected during its progress three or four times by a sub-overseer on Rs. 30 to Rs. 40 a month. There appears to be a misunderstanding on this subject.

4,324. (v). When private agencies exist in abundance and can be relied upon for honesty and capacity, there will be no need for government to encourage local bodies to make use of them. The idea of encouraging local bodies to depend more upon their own staff and less upon that of the Buildings and Roads Branch is suggested partly on the grounds of decentralization. The difficulty is that many municipalities would probably not consider the furtherance of decentralization as a sufficient reason for entertaining an engineering staff beyond their everyday needs, and the economy to them of calling in the aid of the Buildings and Roads Branch when an occasional work of complexity and difficulty arises would outweigh any such consideration.

(2). If the "encouragement" took the practical form of monetary assistance by government towards the salaries of the engineering staff of the local bodies, such would doubtless be gladly accepted, but the result might be that a more competent personnel would depend less on "firms of standing" and more on their own work and ordinary contractors.

4,325. (vi). I am entirely in favour of equipping the engineering colleges of India with the best in the way of buildings, models, workshops, plant, and professors that the state can afford, but I fear the colleges will be de-populated by the transition stage when government

* See Punjab Government, Public Works Department, Buildings and Roads Branch, Circular No. 14-G., dated 28th August 1916.

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appointments are few and private practice is in the hands of engineers who will employ only men with experience and will require students to work gratis, or even pay for being articulated.

4,328. *Conclusion.*—I agree with the objects of the reorganization, but in its execution I think *festina lente* should be a maxim. Harm will be done to the country if it is deprived of the Buildings and Roads Branch before it is quite evident that the private agencies are enough in number to provide competition, and have been in existence long enough to earn a reputation for fair dealings. It seems quite probable that industrial

progress will in the near future create such demands for engineering talent that the attempt to encourage it by borrowing government assistance whenever possible will be comparatively a very small factor in the growth of the profession.

(2). When the canals and rivers of the Punjab are made to yield the power now running wantonly to waste, this province will become a great industrial centre making cement, artificial manure, cotton goods, and woven goods, and in those days I think the local Government would be well advised to retain the services of a select body of engineers competent to assist in the development.

Mr. A. R. ASTBURY called and examined.

4,327. (*President.*) The witness stated that he was a member of the Public Works Department with nearly 17 years' service, and that he had since October 1916 held the post of Sanitary Engineer to the Government of the Punjab.

4,328. He did not possess any special qualifications for the post of Sanitary Engineer, except that he had been employed on sanitary works as an Executive Engineer and on water-supply schemes at the commencement of his service.

4,329. The Buildings and Roads and Irrigation Branches of the Public Works Department in the Punjab were entirely separate, and though cases had occurred in which officers had been transferred from one branch to the other, such cases were very rare, and each branch was practically wholly self-contained. Buildings and roads work in irrigation circles was not attended to by irrigation engineers; such officers only looked after the buildings belonging to their own branch and all other buildings and roads work was entrusted to the Buildings and Roads Branch and to the staff of local bodies. Hence there were in the Punjab three sets of engineering staffs in charge of works in the same area, viz., an irrigation staff, a buildings and roads establishment and a local board staff. A system under which irrigation engineers would undertake buildings and roads work in irrigation circles had been considered, during the Lieutenant Governorship of Sir Louis Dane, but the scheme had not been given effect to owing to the fact that irrigation officers had contended that their own work fully occupied their time and left them none to devote to additional duties.

4,330. Specialization in the Buildings and Roads Branch of the Department should further be encouraged. As regards the Sanitary Branch he suggested that a British officer with not less than five years' sanitary experience should be recruited as Assistant Sanitary Engineer, in order that the branch might derive advantage from the addition of new ideas on sanitation. He recommended the appointment of a mechanical engineer also to advise local bodies and Public Works Department officers on the maintenance of their machinery. A considerable number of road-rollers were kept in stock by the Punjab Public Works Department and on certain occasions hydro-electric plant had had to be procured, e.g., during the construction of the Simla hydro-electric scheme, and the maintenance of such plant needed the services of a mechanical engineer. In view of the fact that the quantity of plant possessed by the Buildings and Roads Branch might be insufficient fully to occupy the time of such an officer he suggested, however, that the services of the mechanical engineer might be shared with the Irrigation Branch. One of the firms which at present undertook the erection of machinery was employed to inspect water-works, pumping engines, etc., possessed by local bodies.

4,331. Tenders were invariably invited in the Punjab on a special printed form and the amount of departmental construction undertaken was practically negligible. Lump sum contracts were never called for. Tenders, at a certain percentage above or below the Public Works Department advertised rates, were accepted. The rates and the total amount of each estimate were always advertised. He did not approve of the suggestion that contractors should be permitted to tender for entire works in lump sum. Such a course would be impracticable in the Punjab, as the contractors in the province

had no rate list, such as 'Lockwood's Price Book,' to refer to and possessed no system of maintaining accounts. The rates they would, in such an event, put forward would be arrived at entirely at random and the scheme would have the effect of penalizing the smaller contractors to a great extent. Hence it would be disadvantageous since certain smaller contractors were at present extremely useful.

4,332. It was a common practice to invite tenders for entire projects in the case of works worth less than about Rs. 20,000, but where amounts above that sum were involved the question whether contractors capable of performing the work were available or not had to be considered. His own experience had been confined to Lyallpur and Simla and in the latter station he had known of contractors who were competent to accept work up to about Rs. 50,000. He agreed that the method of splitting up large contracts was unsuitable for the encouragement of private enterprise, and added that he personally had always invited tenders whenever possible, for amounts which he thought were the largest the contractors concerned were competent to undertake. He therefore approved of the suggestion that provided firms of sufficient standing tendered for works, contracts for entire projects should be entered into.

4,333. Tenders were generally invited for the repairs connected with each group of buildings situated in the same civil station. All the measurements of periodical and annual repairs were recorded in standard measurement books once for all and stereotyped annual repair estimates were framed and tenders invited on the basis of such measurements. The object of the standard measurement book and of such stereotyped estimates was to save the labour involved in constant measuring up of, for instance, the same room year by year for, say, white-washing, and he personally had found the system saved a great deal of clerical labour. The need for a repair estimate existed as long as it was considered necessary to measure up work which had been performed, and detailed printed estimates were useful inasmuch as they showed the probable cost of maintaining buildings in repair year by year. The standard percentage for repairs served rather as a guide to fixing rates than as a limit to which repairs should be confined, and the printed estimates did not include such an item as broken window panes. An item at the end of each such estimate designated "petty works" included such items as broken panes, etc., and the recorded measurements included routine works, such as white-washing, plastering, colour-washing, etc., which were undertaken once or twice in a year.

4,334. Stereotyped estimates for repair work did not cause a considerable amount of trouble to the Executive Engineer as they were printed up after they had once been passed by that officer. He was, however, not averse to the proposal that repair estimates should be dispensed with and Executive Engineers allowed to maintain their respective buildings in repair within the limits of an annual grant for each building. A stereotyped estimate was framed as each building was built and was subsequently taken as the approximate annual estimate. No detailed yearly estimates based on the cost of maintenance were subsequently framed.

4,335. As regards the construction of roads he had always found it more convenient in the plains to split

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up each contract into three different parts, one for the earth-work, to be carried out by a contractor of the *And* class (the best people available for this kind of work in the Punjab); a second for the stone-work, which was generally given to a contractor interested in the quarries and a third for the carriage of stones which was usually given to a man with a good deal of local influence who was competent to arrange for transport. If road contracts were not divided, but given out to single individuals, it would prove a more expensive system.

4,336. Annual petty road repairs were almost entirely executed departmentally. The renewal of coats of metal for particular road lengths was generally done by contract though government as a rule supplied all imported stores, except such petty stores as might be obtained locally in the bazaar.

4,337. It was exceptional for government to maintain brickfields in the Punjab for the supply of bricks to contractors, but one such brickfield had been erected at Lyallpur in connection with the Agricultural College at that station. Government brickfields were only established in cases where it was impossible for contractors to obtain their bricks in the open market.

4,338. The Punjab Government supplied their contractors with cement because less risk of adulteration was incurred by keeping cement in the stores depot until it was required for use. He personally did not consider such storage necessary in the case of large contracts provided the cement supplied by the contractor was up to specification. But in the case of small works it was an advantage to contractors for government to arrange for the supply of cement.

4,339. There was no necessity so far as the Buildings and Roads Branch was concerned for indents for stores to be made on the Secretary of State as in the large majority of cases such articles of European manufacture as were required could be purchased in India in the open market. Only occasional articles, e.g., a ventilating fan, which were not ordinarily stocked in India should be obtained through the Secretary of State. He expressed himself as willing to recommend that the system of indents on the Secretary of State should be abolished altogether and that Executive Engineers should be allowed to make their own arrangements for the purchase of such stores of European manufacture as they might require.

4,340. Except for certain local tests which the Punjab Public Works Department undertook themselves, that Department depended generally on the government tests carried out at Alipore as no special arrangements had been made in the Punjab for testing materials.

4,341. A system of classifying contractors according to their status, i.e., those capable of carrying out works above a certain amount, below that amount, and so on, was not followed in the Punjab, and the framing of a record of the work of each contractor had not been officially laid down. Whenever he had taken over charge of a division he had never had handed over to him a confidential account of the work of the contractors in that division, but he had always maintained such an account himself, since he considered such a practice to be advantageous. He did not consider it was possible to classify contractors according to their reliability and financial position with a view to ascertaining the extent to which detailed subordinate supervision over them might be reduced. On the contrary he thought it would be very difficult to work such a system, particularly as it appeared to him to be unbusinesslike.

4,342. The organization of the Buildings and Roads Branch would not be improved by the abolition of Superintending Engineers and the proportionate improvement of the status of Executive Engineers, because the Chief Engineer would in such an event be greatly overburdened with office work; a somewhat similar system had been tried in the Military Works Department some years previously. The organization of that service consisted of a Director General of Military Works, a certain number of Commanding Royal Engineers and Assistant Commanding Royal Engineers who corresponded to the Chief Engineer, Superintending Engineers and Executive Engineers of the Public Works Department. Attempt had

been made to dispense with the Commanding Royal Engineers and to allow the Assistant Commanding Royal Engineers to correspond direct with the Director General, but the scheme had proved a failure. It was too much to expect the Chief Engineer to deal direct with about 16 or 18 divisions. The amount of supervision exercised over Executive Engineers was not excessive at present, and he personally did not think that the Executive Engineer was given neither the position nor the responsibility that should be attached to his post.

4,343. No material advantage would accrue from the centralization of designs in certain special designing offices as the staff in such offices would not be in complete touch with the needs of the officers on the spot. Arrangements would have to be made by correspondence and not by interview. It was besides unsound in principle to divorce designing from an engineer's duties because it would have the effect of taking away such an officer's chief interest in works.

4,344. Architectural works in the Punjab were at present mainly designed by the Consulting Architect, but it was not the case that that officer undertook only specially large projects, since officers' residences had been designed by him and he had also supplied details such as those for doors and windows. Designs for engineering works such as roads, bridges, etc., were prepared by the Public Works Department staff, and the witness himself had, when an Executive Engineer, before the advent of the Consulting Architect, designed details for the Agricultural College at Lyallpur and also certain buildings at Simla.

4,345. The question whether promotion to the rank of Executive Engineer should be made by selection or by seniority was a very difficult one to answer and he had no definite views to put forward in this respect. But he thought that promotions in the Punjab to that rank had in the past been made more by rejection of the unfit than by selection.

4,346. In explanation of his statement that the Public Works Department in the Punjab had functions connected with the Boiler Act, he stated that the boiler inspectors formed for administrative purposes a portion of the local Sanitary Department, and that the correspondence and accounts connected with their posts were dealt with in his office. The reason for this arrangement was the desirability of placing such officers under the control of the head of the engineering department. The boiler inspectors had no connection with the factory inspector, as was the case in other provinces, but were subject to the control of the local Sanitary Engineer. The factory inspector was under the Director of Industries.

4,347. Local bodies should not be expected to control government buildings and roads but only their own works, since it was wrong in principle that a local body should be made responsible for works for which they did not pay. He admitted that it was objectionable to have a duplication of staffs in districts, but remarked that the question of whether government or district boards should undertake all works in districts depended on which system produced the best men for the work. The quality of the staff was the main consideration and if government controlled district affairs there would be a better chance of securing good engineers than if local bodies possessed this control. It was not possible to persuade efficient engineers to come out from England to serve under local bodies with possibly a non-official non-professional chairman who would interfere with their work. There were only three towns in the Punjab which employed engineers of their own of a fairly high standing and except in Simla, which was an exceptional instance altogether, these officers were constantly being changed. His objection in effect was that local bodies in the Punjab were not sufficiently developed to be entrusted with work of the magnitude involved. Simla was run on proper lines and it was possible to get good engineers to stay in such a place.

4,348. The Executive Engineer in the Punjab was ordinarily a member of the district board, but since such officers did not always attend district board meetings they had not in many cases an inner knowledge of the working

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of the boards. The civil divisions besides did not correspond with the Public Works Department divisions and an Executive Engineer might have four civil districts not contained wholly in his division.

4,349. It had gradually become the prevailing practice in the Punjab for the Sanitary Engineer to design important sanitary projects which had formerly been designed by Executive Engineers. Three cases had occurred however in which a local body had employed a certain private firm to prepare designs for drainage works at Lahore, Multan and Amritsar. Though the initiative as to whether they utilized the services of the Sanitary Engineer to Government or those of a private firm rested entirely with a local body, the local bodies had, as far as he was aware, consulted the Sanitary Engineer to Government in the three cases referred to before they employed the private firm. Government had not made it a condition that the designs for sanitary works towards which they made a grant should be prepared by the Sanitary Engineer, but merely insisted on that officer certifying such designs when prepared.

4,350. When a sanitary project was prepared in his own office an estimate was also worked out, but the rates in the estimate were filled in in the office of the Superintending Engineer concerned and his office merely entered the quantities.

4,351. Both a preliminary and a detailed project were prepared for sanitary works, and the Sanitary Engineer allowed the local body concerned to prepare such projects if their staff were competent to do so; otherwise the work was entrusted to the local Executive Engineer or to the office of the Sanitary Engineer. If a detailed project was prepared by the staff of the local body that staff carried out construction as well, presumably because if they were considered competent to prepare a project they were also competent to construct the work. Similarly, if an Executive Engineer prepared a project he carried out construction. A system had recently been adopted, however, under which a special sub-division under the direct control of the Sanitary Engineer had been constituted to construct sanitary works and selected water-works.

4,352. The construction of sanitary works was carried out under the piece-work system by the employment of the largest contractors available. Large firms had been employed on entire sanitary works in the Punjab. The sanitary installation at Government House, Lahore, for instance, had been carried out by a firm from Lucknow and the machinery portion of certain water-works by another firm. The existing system had, he added, hitherto worked satisfactorily.

4,353. The sanitary sub-division in the Punjab had been created to provide supervision over the construction of sanitary works irrespective of whether they were carried out by large firms or not. It had not been constituted to undertake departmental construction.

4,354. By the suggestion in his written statement to the effect that since sanitary works were not maintained in a satisfactory manner by local bodies owing to the fact that such bodies did not appear to realize their responsibility for maintaining water-works and drainage schemes the Sanitary Department should be constituted in such a way as to provide efficient inspection of such works, he did not desire to imply that government should undertake to maintain all sanitary works. Such a course should only be adopted in special cases in which it was clear that maintenance by the local body was so defective as to warrant its being taken over, and then only for as long a period as would suffice to bring the works in question up to standard when they should be handed back to the local bodies concerned. Both he and his personal assistant were responsible under the existing system of government inspection. No special time had been laid down for such inspections and he was expected to undertake this duty only when invited to do so by Commissioners and when matters of special interest arose. The local Public Works Department officers did not inspect sanitary works belonging to local bodies unless specially invited to do so.

4,355. Sanitary Engineers should be recruited in the first instance from England as junior sanitary Assistants. Young men with sufficient experience and knowledge to assist the Sanitary Engineers were what were chiefly needed, but when such officers were promoted to the rank of Sanitary Engineer their Assistants should be men who had a knowledge of the country and who could be trained ultimately to fill their places. It would be advantageous if in the immediate future either the Sanitary Engineer or his Assistant had had an English training.

4,356. The Executive Engineer should be relieved of such accounts work as amounted to mere compilation for the purposes of imperial statistics, and the accountant in the divisional office should be made responsible for such work. Though this might not relieve the Executive Engineer of a substantial portion of work and was but a very small item, it would amount to sanctioning one of the recommendations of the accounts committee that had met some years ago. This committee, which originated from the amalgamation of the public works and civil accounts, had suggested that the signature of the Executive Engineer on such documents as were mostly compilations should be dispensed with.

4,357. He agreed with the contention put forward by certain Executive Engineers that their accounts work took up but a small portion of their time, and that it was essential for them to have a certain amount of such work as otherwise they would not be sufficiently acquainted with progress of expenditure on their respective works. He however confirmed the suggestion in his written statement to the effect that compilation by sub-heads should be undertaken only for works worth above Rs. 10,000 instead of for those worth above Rs. 5,000 and that separate sub-heads should not be maintained for individual items worth less than Rs. 1,000.

4,358. As he had not found the present system of making allotments for individual works harassing, he doubted whether it would facilitate work if, instead of receiving an allotment for each particular work, Executive Engineers were allowed to spend on their listed works against allotments to their Superintending Engineers for all the works in the circle. The present arrangement involved merely an inspection of the divisional accounts once a month and suggestions for reappropriations, etc. to the Superintending Engineer, and he personally had not found the present method of making reappropriations to be a burden.

4,359. (Sir Noel Kershaw.) He agreed with the suggestion that tenders from reliable contractors who needed less supervision should be accepted in preference to those from firms which were considered less reliable, even though the former might be a little higher than the latter.

4,360. The reasons for and against the promotion of Assistant Engineers by seniority or merit were so equally balanced that it was impossible for him, even after 17 years' experience, and in spite of the fact that he had considered the question, to form a definite opinion.

4,361. Sanitary matters and even roads were to a certain extent more or less matters of local self-government. It would not be necessary to recruit sanitary Assistants from England if local boards and municipalities possessed competent sanitary engineers.

4,362. Friction with the members of local bodies was the reason why the municipal engineers he had previously referred to were continually being changed. These officers were possibly tempted to please certain members and in consequence found themselves out of favour with others. Simla was the only exception of which he was aware in this connection. He explained, however, that he had heard the complaints from the side of the engineers and not from that of the local bodies, and that his remarks referred solely to the Punjab. Hence he was not able to suggest means of removing such complaints, or to state whether they existed in other countries and were well-founded.

4,363. Sub-heads should not be dispensed with altogether. He objected to the necessity for comparing rates each month with estimated rates. Hence he had

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suggested that the limit for the maintenance of sub-heads should be raised from Rs. 5,000 to Rs. 10,000 so as to avoid the necessity for striking the rates monthly. The same purpose would be served by altering the rule under which rates were required to be struck monthly. To the contention that the reason for that particular rule was that it was considered essential in order that Executive Engineers should be kept aware of how expenditure was progressing against an estimate, he replied that it was only necessary in the case of works which were carried out departmentally and that it was unnecessary in the case of works executed by contract. He agreed, however, with the contention that unless the Executive Engineer kept details to show exactly what rate, say, earth-work was working out to, that officer might be very considerably out in his total, and modified his recommendation to apply only to such works as were done by a single contract against estimated rates. He added that the striking of rates monthly was unnecessary in such cases.

4,304. (*Mr. Mackenzie.*) Executive Engineers' accounts were maintained as a means of making payments to contractors and of showing what the works actually cost. He desired that the register of works should be maintained, but that when not necessary rates should not be struck monthly. The register of works by sub-heads was an account showing the expenditure against the estimate, and an addition of the sub-heads resulted in the total expenditure. This, however, was not all that an Executive Engineer should know; that officer should also be acquainted with the progress of expenditure against individual sub-heads. The contractors' ledger was invaluable to an Executive Engineer and it would not be possible to work without it. The account current was merely a means of obtaining funds from the Accountant-General and changes in it had been suggested by the accounts committee he had previously referred to. The system of paying salaries had also been dealt with by that committee. The arrangement at present in force in the Punjab was neither the Public Works Department system nor the civil accounts system and the system of treasury payments had not been introduced in the province. Great improvement would result from the recommendations of the accounts committee referred to, above.

4,305. He did not know whether at the time when Commanding Royal Engineers were abolished in the Military Works Department, Assistant Commanding Royal Engineers had been given considerably enhanced powers, but if Superintending Engineers were dispensed with, though the powers of Executive Engineers might be increased proportionately and relatively, the Chief Engineer would be obliged to correspond with a considerably larger number of officers than was the case at present. The Director-General of Military Works had told him that the system tried in that department had proved a failure.

4,306. Standard measurement books were used for measuring work, and the present arrangement under which subordinates supervised repairs was suitable to India. Executive Engineers signed standard measurement books and were the disbursing officers.

4,307. (*Rai Bahadur Ganga Ram.*) Isolated instances of buildings at the headquarters of an irrigation sub-divisional officer were not considered when the system of transferring buildings and roads work in irrigation circles to the Irrigation Branch was discussed during the Lieutenant Governorship of Sir Louis Dane. He agreed, however, that it would be much better for an irrigation sub-divisional officer to attend to the construction and maintenance of, say, a *thana* at that officer's headquarters, rather than that arrangements should be made to send a sub-overseer of the Buildings and Roads Branch to undertake the work.

4,308. As Sanitary Engineer he was not held responsible for the maintenance of the pumping plant possessed by local bodies, but he kept an eye on such plant. He added that he was the first person to whom local bodies appealed when anything went wrong with their plant.

4,309. The fact that he, as Sanitary Engineer, occupied the position of president under the Boiler Act enabled him to maintain touch with the boiler inspectors; and the fact that he exercised functions under the same Act facilitated his work in that it kept him in touch with the *mistri* class who dealt with boilers and machinery.

4,370. A former Sanitary Engineer might have taken the initiative and recommended that the designs for the three sanitary works previously mentioned should be given to the private firm which had received the work, but that was before his time.

4,371. There were certain upper subordinates in the Punjab who were not fit to hold charge of a sub-division and there were certain lower subordinates who were better able to do so, but it was very difficult for government to apply the remedy of weeding out inefficient officers and promoting others arbitrarily.

4,372. He favoured the abolition of the distinction between upper and lower subordinates and the suggestion that all subordinates should start from the lowest grade on a salary of Rs. 50, but did not think there was any necessity to recruit a portion of the lower subordinate staff from the *mistri* class, i.e., after giving the latter a further training to give them permanent appointments. There had been instances in which *mistris* had been promoted to the lower subordinate grades but this class of men was and is generally engaged temporarily on the works establishment to watch government works, and he knew of some who had been in the continuous employ of the Department for about 45 years. He considered, however, that they should always be temporarily employed in order that the best benefit might be got out of them.

4,373. The ordinary standard percentage of works establishment to works charges employed in the Punjab was 2 per cent. This, however, applied solely to major works, since no percentage had been fixed for minor works. It was not the practice to consider when preparing an estimate for a major work such details as the number of *mistris* that might be needed, etc., 5 per cent. was added to each estimate for contingencies.

4,374. Although the Accounts Department required Executive Engineers to pay on measurements, payments were in practice, though not invariably, made without measurements. He considered it better instead of making payments on a half or a quarter of a work to put down the regular figures, as was done at present, and to make payments on them.

4,375. Advances to contractors were not sound in principle. A monthly payment on account was all that a contractor of good standing should reasonably expect.

4,376. (*Mr. Cobb.*) There were a certain number of inefficient officers in the service and it would be better for the service as a whole if such individuals were weeded out, but to effect such a course meant a strong government with a strong officer at the head of the service. A strong Chief Engineer would be able to remove an inefficient from the service provided there was a strong Lieutenant Governor to uphold his action to the Secretary of State if the latter were inclined to defend the officer in question. There was too much latitude allowed for appeal under the existing arrangement, and government would have to change their policy in order to make it possible for inefficients to be weeded out of the service. The policy at present was to promote men in the executive ranks almost entirely by seniority and even conspicuous failures were retained. But though the present arrangement was not satisfactory the question was really one on which he preferred not to express an opinion.

4,377. Executive Engineers should be allowed full disciplinary powers over temporary establishment, but in respect to the permanent staff the existing arrangement should be maintained under which the Chief Engineer was the final authority. Powers of dismissal of even lower subordinates should not be delegated to Executive Engineers; such officers were in direct charge of works and if accorded the powers in question might perhaps be hasty and consequently liable to dismiss a man for insufficient reasons. Superintending Engineers might be entrusted with powers of dismissal

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of lower subordinates, however, subject to an appeal to the Chief Engineer. The number of inefficient was about ten per cent. of the whole and he did not consider the retention of this number in the service constituted a considerable handicap on the Department.

4,378. It was not the case in the Punjab, as had been contended in evidence in other provinces, that when works were advertised for tender it was generally known beforehand which contractor would receive a particular work. This could only be possible in the case of large works when there was only one capable contractor in the district. The contractors usually employed might know about 30 per cent. of the rates which occurred over and over again, but there were always new items which they would not be acquainted with in the ordinary course of events.

4,379. Except in the case of very large municipalities, local bodies in the Punjab were not in a position to secure the services of really good engineers. He had formed this conclusion from his experience of English-trained engineers who came to him for advice as to how they might secure employment. Such officers refused to accept work under a district board, not on account of salary, but because they did not like to be dictated to by district board members.

4,380. (Mr. Aikman.) In view of the fact that contractors in the Punjab tendered at rates which were generally a percentage above or below the Public Works Department schedule of rates the witness was asked what steps were taken to ascertain that the Public Works Department rates were fair market rates. He referred in his reply to the Simla Division, the last division of which he had held charge and stated that that division, which was one of four in the Second Circle, was exceptional, inasmuch as the rates contained in the general schedule for the circle were not applicable to it. Simla contained classes of stone and wood-work that were not found in the plains, and he had in consequence found it necessary

to prepare a special schedule complete in itself for that division. This schedule contained specifications and analyses of rates, which analyses were divided into three items, viz., cost of materials, cost of labour and profit to contractor, because each rate really consisted of these three items and was incomplete without a specification. In Simla the Department ascertained from time to time whether the rates in their special schedule were comparable with market rates by making tests on the site of works.

4,381. From his own experience he concluded that the tenders put forward in the Punjab were as a rule generally below the estimated Public Works Department rates by between 4 to 12 per cent. He had made a comparison of the rate at which work was carried out by private individuals with those of the Public Works Department while at Simla, but had found that the instances he had taken were unfortunately not very comparable because in all masonry works the Public Works Department in Simla supplied their own mortar, which was made in a government manufactory and which was in consequence more costly than the local mortar imported from the plains. On two or three occasions, however, he had acted as arbitrator between a contractor and a client and had found that the agreement entered into between the two had been generally that the rates should be the Public Works Department rates which were accepted by the public as being quite fair and reasonable. Except in connection with masonry works, the rates for private works in Simla were practically the same as for government works, but private individuals added, he thought, not 5 per cent. for contingencies but 10 per cent. though they did not add a percentage to cover the cost of a works establishment. Hence the private rates included the cost of the supervisory establishment whereas the Public Works Department rates excluded that factor. He had not taken into consideration the cost of establishment on either side when he made his comparison.

RAI BAHADUR KANHAIYA LAL, Executive Engineer, Public Works Department.

Written Statement.

4,382. To begin with I base my memorandum on the following considerations.

(1). The root cause of the appointment of this Committee seems to be the intention of the Government of India to ascertain how far they can give effect to the following recommendation of the Public Services Commission:—

"The Public Works Department should confine itself strictly to work which cannot be discharged either by private enterprise or through the agency of district-boards and municipalities with the necessary financial support from the Government."

(2). The secret of success of the British government in my opinion, rests on the system of "supervision" and "audit" which should never be lost sight of.

(3). As long as all the buildings and roads that are constructed will exist, they will demand supervision and audit by some agency or other.

(4). The district boards and municipalities are *quasi* or semi-government institutions, if not entirely government.

(5). It seems to be the intention of government to teach the people of India to learn to manage their own public affairs and thus to relieve government of the multifarious ordinary duties and to enable it to devote its attention to higher duties required of a good governance.

(6). In the construction and maintenance of all works economy consistent with the efficiency of establishment and good quality of material and workmanship must be aimed at.

(7). *Merit* and *good work* should form the criteria for defraying public money without distinction of caste or creed.

(8). The present dual control of works in one and the same district or station should be obviated altogether.

(9). If any change is to be effected it should be made gradually and not drastically by a stroke of the pen.

(10). Any changes to which the poor Roads and Buildings Branch of the Public Works Department is susceptible, will apply, more or less, to the other branches of Irrigation and Railways.

4,383. (I.) Economy and suitability of methods of execution of public works.—The methods in vogue at present for the execution of works are,

(a) by contract, and

(b) by departmental agency;

under the strict supervision and control of the Public Works Department or district board establishments including keeping of accounts subject to audit by the Accountant-General of the province. I presume the Committee is acquainted with these methods and I need not describe them *in extenso*.

(2). These methods are certainly *economical* for the supply of materials and carrying out of works, but are not so from the point of view of *establishment*, because at present the distribution of roads and buildings under the charge of the Public Works Department and district boards are so blended that in one and the same place the repairs of a building are consigned to district boards and its original works to the Public Works Department, or there are a few buildings under the Public Works Department and a few under the district board; so that officers of both agencies go to the same place and their subordinates live together, and the public money is unnecessarily spent in paying dual establishments. *Therefore this redundancy demands correction to effect economy.* The Indian labour is cheap and low while much of the supervising staff is a highly paid imported agency in which there is room for effecting economy.

(3). The current methods are *suitable*, but are not *synchronous* and *consonant* with the *advancing times*. For

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instance, there was a time when no trained subordinates and officers nor contractors were to be had and military sergoants and officers and ordinary old type *mistris* used to be employed for constructing large works like the Grand Trunk Road and Government House buildings by monthly and daily labour departmentally. I have had serve under me several old sub-overseers, overseers and supervisors who had started in life as mates, time-keepers or work-*munahis* and who hardly knew even how to write names and numerical figures, and then mostly in vernacular and seldom in English. I have had to convert several masons, carpenters and *mistris* into petty-contractors some of whom subsequently grew into big personages, whereas now the time has come when England-returned engineers in small numbers (*vide* the memorandum of the Public Works Department Secretary, Punjab, "During the last two years about 15 Indians trained in engineering in English universities have sought employment in the Punjab Buildings and Roads Branch") and Indian college-passed engineers, and good contractors can be had in large numbers.

(4). Therefore, it is quite opportune now that government should devise a system so as to avail itself of the services of qualified men and experienced and reliable contractors, who are the production of the British government, for the execution of public works.

4,384. (II.) Encouragement of other agency.—Under the existing system the *properly speaking indigenous private enterprise* is not encouraged at all except in the case of large works of special nature requiring expert knowledge of machinery, sanitary works and hydroelectric schemes, in which European firms who are specialists in these branches have been employed. In fact hitherto large firms of engineers and contractors are non-existent in the Punjab and the works are generally carried out by local contractors under the guidance, assistance and supervision of the departmental agency.

(2). During the Hindu and Muhammadan times of government the method of execution of works by contract was unknown in India and all works were done by government agency. The Nolakha palace of the Lion of the Punjab, the tomb of Jahangir, the Taj Mahal, the Hindu Chhat Khamba and the Qutab Minar were not built by contractors. But owing to the spread of education and experience of half a century gained during the regime of the British government both educated and retired engineers and subordinates and experienced contractors are cropping up, who, if given opportunity and encouragement, would be suited individually or in body corporate for private enterprise in the near future.

(3). Hence, to my mind, it not only seems quite possible and highly desirable, but most opportune and timely to entrust the construction and upkeep of public works to private agencies to provide work and means of livelihood for the people of the country and foreign engineering firms.

(4). This procedure is in vogue in England and there seems no reason why it cannot be introduced in India at the present advanced state and connection between the two countries, like the system of legal practice which was once equally an exotic plant to the Indian soil. Consulting engineers, consulting architects and builders by contract shall come into existence in the near future like barristers-at-law and L.L.Bs. It is simply a question of demand and supply. As an illustration, I may mention that only a couple of months ago I received a letter from Messrs. ——— of Bombay informing me as cited below :—

"For the benefit of our customers we have made arrangements with Mr. ——— Architect of Bombay, to act as our consulting architect and engineer in special causes where designs are required in connection with buildings, and decorative treatment of buildings.

We would state that Mr. ——— was responsible for the designs of the buildings of the Punjab King Edward Memorial, at Lahore, and numerous other works in India, and we feel confident that our choice has fallen on the right person.

If necessary at any time arrangements could be made, for Mr. ——— to give a personal interview or visit. Terms and particulars can be obtained on application."

Similarly, an Indian engineer has introduced in Delhi the manufacture by machinery of plain and ornamental cement tiles for flooring purposes.

(5). I now proceed to point out the lines upon which such a change should be gradually effected :—

(a). The construction of all original buildings on standard designs and new unmetalled and metalled roads may be carried out by private agencies subject, of course, to government inspection, measurement of works done and audit.

(b). The repairs and maintenance of public buildings and roads may also be treated accordingly.

(c). When success is attained in works of simple and unimportant character, and competent and reliable agencies come into existence, the construction of large and important works might also be entrusted to them subject always to government supervision and audit.

(d). For contracts individuals or firms should be selected by open competition.

(6). To me it seems quite certain that in due course of time this procedure would lead to fair economy and greater efficiency and what is a *desideratum* now to greater industrial activity and the acquisition of professional knowledge and education. This procedure would open new fields to the Indians who would send their children to foreign countries to become not only engineers and architects but specialists in numerous arts and sciences, mechanism and various other branches of engineering instead of turning them out as lawyers and doctors, which professions are more or less overstocked now. It is rightly pointed out by the Punjab Government that *cases of private agencies being employed by government under existing conditions would be so few and far between that they could not hope for financial success*. To obviate this apprehension I am bold to say that in the course of nature time would come when private agencies might be able to undertake not only the works of the Roads and Buildings Branch but also of the mighty canal and railway branches, as well as works of private well-to-do persons, industrial firms, rajahs and maharajahs.

4,385. (III.) Changes in organization.—The changes indicated above would certainly necessitate modification of the organization of the staff and the method of execution of work both of the Public Works Department and local bodies.

(2). I would propose the following reorganization scheme :—

For direction, supervision and control of all works of the Public Works Department and the local bodies the Chief Engineer and Secretary to Government, the Superintending Engineer and the expert Sanitary Engineer, Architect, Electrician, etc., and the Accountant-General or Examiner are to remain intact as at present.

(3). For the execution of works I would suggest the organization of a local works service of a permanent non-pensionable character along with the Public Works Department permanent pensionable service. All the members of both services should be well qualified and be certified students of engineering schools and colleges or similar institutions.

(4). The rates of salary for the former should be as per scale prescribed by the Public Services Commission for officers recruited in India. In place of pension they should be granted the benefits of a *provident fund* constituted on the same lines as the state-aided provident funds of government railways.

(5). In all respects, other than in regard to pay, leave and pension, there should be no distinction between the members of the local and Public Works services.

(6). All the establishment belonging to government and local bodies should be brought on one list or cadre according to the various classes of service they belong to. While serving in district boards they may be designated district engineers, district sub-engineers, and so on; and when serving in the Public Works Department Executive Engineers, etc., as now.

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(7). They should be liable to transfer from one board to another and to Public Works Department works in accordance with the nature and amount of works and other circumstances, and promoted to extent which they deserve and are qualified for.

(8). The Superintending and Chief Engineers should be selected and promoted from both services alike and receive uniform rates of salary in all the administrative grades.

(9). The scale of salaries of upper and lower subordinates and of lower grades of accountants and of office and petty establishments should be increased to enable them to lead decent and honest lives according to the circumstances of the present times. Because about half a century ago when those scales were fixed the prices of all commodities and the conditions of life were much cheaper and quite different from now. I would recast the salaries as below :—

Upper subordinates in all grades from Rs. 100 to Rs. 500.

Lower subordinates in all grades from Rs. 50 to Rs. 130.

Accountants in all grades from Rs. 100 to Rs. 500.

Office establishment in all classes and grades from Rs. 50 to 500.

Petty establishment of sorts from Rs. 15 to Rs. 25.

(10). I would propose to augment the lower subordinate class by introducing sub-overseers of the *mistri* class taken from craftsmen like masons, carpenters, blacksmiths, etc. We feel great need of such subordinates who may be able to execute occasional and petty repairs with their own hands and find out the defects in the workmanship of their own brother workmen. The *mistri* sub-overseer would readily meet this want. I beg the Committee's permission to introduce Sardar Buta Singh who started under me as a road-*munshi* at Bannu in 1886 and is now a sub-engineer. He has rendered meritorious services in the last two imperial durbars at Delhi.

(11). Further economy can be effected by decreasing the number of Assistant Engineers and increasing that of upper subordinates for manning sub-divisional charges as recommended by the Public Services Commission.

(12). For special lines such as architecture, sanitary works, mechanical and hydro-electric works I would import experts on special salaries from England and other countries only as long as they are not obtainable here.

(13). The temporary staff should be entertained either for a specified item of work or for a *bona fide* limited term say one to three years. They should never be appointed for works on which they may remain continuously employed for a great number of years having their appointments sanctioned year after year. There need not be any provident fund provision for them. Any temporary man whose services may be retained after three years should be brought on the permanent non-pensionable list mentioned in sub-paragraph (3) *supra*.

(14). In the Punjab there are at present 3 circles, 11 divisions and 24 sub-divisions of the Roads and Buildings Branch of the Public Works Department to carry out public works. And there are 5 divisions, 28 districts and about 126 *tehsils* in which local works are carried out by district boards from incorporated local funds. Further there are 7 first-class and 99 second-class municipalities and 83 notified areas which carry out almost all the municipal works. All these carry out buildings and roads works both original and repairs by their own agencies except that certain metalled feeder roads are consigned to district boards and certain large municipal works are carried out by the Public Works Department.

(15). I would propose to organize them as follows :—

PRESENT.	Nos.
Circles for superintending all works both Public Works Department and district board	3
Public Works Department divisions corresponding to revenue divisions with headquarters of Executive Engineers at the headquarters of Commissioners, for executing large works	5

PRESENT.	Nos.
Public Works Department sub-divisions in accordance with the nature and amount of works, about 2 per division, say,	10
District boards works may be divided into major and minor divisions.	
First-class district boards into major divisions, say,	8
Second-class district boards into minor divisions, say,	20
District Board sub-divisions, each comprising about 4 <i>tehsils</i> , say, $\frac{126}{4} =$	32
The municipal works may either be treated separately or the seven first-class municipalities may be formed into separate municipal divisions, say	7

And the 99 second-class municipalities and 83 notified areas may be placed under the charge of upper and lower subordinates in accordance with the extent of their works.

For special works like the King Edward Memorial at Lahore, special divisions and sub-divisions may be formed as circumstances may warrant. For large sanitary works like the Delhi or Amritsar water and drainage works, special divisions may be formed and worked under the direct superintendence of the Sanitary Engineer. The minor sanitary works should be carried out by district board divisions. Similarly, large and small architectural and electrical works may be carried out by the Public Works Department and district board divisions respectively under the guidance of an expert Government Architect and Electrical Engineer.

They must all be under the direction and control of the Chief Engineer, Roads and Buildings Branch, and the Accountant-General, Punjab.

(16). At present the major district board divisions should be empowered to carry out all original provincial and district works, each up to two lakhs of rupees, and the minor district board divisions up to Rs. 50,000 and repairs up to the budget grants. All other works over the above limits should be carried out by the Public Works Department divisions.

(17). Later on when the local bodies are found sufficiently advanced and fit to manage their own affairs efficiently the above limits and powers of district board divisions will have to be enhanced. And ultimately the Public Works Department divisions will have to be abolished and the Superintending and Chief Engineers will then act as Inspectors and Directors of works.

(18). The executive and ministerial staff placed under local bodies should be administratively under the presidents of these bodies and civil officers, but technically and for purposes of promotions and transfers under their own professional officers of the Public Works Department.

(19). The advancement of deserving and selected persons should be unrestricted from the lower subordinates to the upper subordinates and from the upper subordinates to the engineer establishment, and of district boards' engineers to Public Works Department engineers. They should when so advanced be entitled to enjoy fully all the privileges of their high positions.

(20). I know that twice during my term of service government buildings and roads were transferred to local bodies and taken back on account of not being maintained to standard. But once in 1885-86 it was due to transferring the highly paid engineering staff without transferring works of equal magnitude and heavy cost, so the local bodies had to return the government engineers and thereby works suffered. Again in 1910 as per Punjab Government, Public Works Department, Circular No. 1-B of 28th March 1910, feeder roads were made over to the local bodies without corresponding government establishment, so the works suffered on account of low-paid and inefficient district board staff, and in both cases for lack of professional supervision and audit by government. In my proposals I have, therefore, taken care to avoid these pitfalls.

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(21). Promising officers of from 5 to 7 years' service might be encouraged to themselves in these subjects for which they may have a taste and in which they have acquired experience.

(22). It is very difficult to comply with the rules and regulations and certificates required for obtaining stores of European manufacture, so I would suggest that a special qualified officer with adequate staff be appointed in an important or a central place in India, like Bombay or Calcutta or Delhi, to receive indents of all officers and to scrutinize whether the articles indented for are obtainable in India from any Indian manufacturing firms or from surplus stores of various departments, and then to arrange for the supply of the same from Indian sources or through the India Office.

(23). The standard plans for buildings like dāk bungalows, police stations, which are required all over the country should be prepared by a select committee for the whole of India to render their construction uniform and economical. The details of materials obtainable in different places, of floors, roofs, etc., may vary to suit different localities, climates.

(24). "Quick payments mean cheap and quick work." So facilities should be given for quick payments for works done in part, as well as for materials manufactured or collected by contractors. Further a system of advancing money to contractors on security of their immoveable properties may be introduced.

(25). Tenders for works up to Rs. 5,000 may be accepted by district board divisional officers and up to Rs. 10,000 by Public Works Department Executive Engineers, and up to Rs. 50,000 by Superintending Engineers and above these amounts by the Chief Engineer and Secretary to local Government.

(26). Regarding the estimates and tenders for tools and plant and office furniture, appointments of staff, their leave and dismissal, the rules laid down in the Public Works Department Code may be followed.

(27). The system of lapses at the end of the financial year is most undesirable. I am not a financier, but would suggest that a sub-head may be opened in the accounts to show the money lapsing in one year reserved for allotment in the year following. If this method were found feasible, it would obviate many drawbacks.

4,386. (IV.) Relations with other departments and sub-branches.—The Public Works Department has to meet the needs of other departments, as its very existence is chiefly for that purpose, there being very little work which may be called purely Public Works Department work. To speak the truth candidly it is a most irksome task to do work for other people so as to please and satisfy them. We Public Works Department men have to subdue our feelings sometimes beyond limit in hearing unpleasant remarks even from officers of inferior position and rank and subordinates of other departments. The obtaining of signatures of various departmental officers on completion certificates is a very hard task enjoined on Public Works Department officers. The wording of the completion certificates had to be altered and modified several times and is much simplified now. But it should be altogether done away with and paragraph 846 of the Public Works Department Code abrogated. The signatures of departmental officers on designs and estimates are quite sufficient to show their approbation and consent. They may be welcome to raise objections or to make any demands or complaints later on to Executive or Superintending Engineers. The success in this matter chiefly depends on the existence of friendly relations between the officers of this and other departments.

(2). As to the relations *inter se* of the various sub-divisions of the Buildings and Roads Branch, I have found them always entirely satisfactory, because after all the Sanitary Engineer, Consulting Architect and Electrical Engineer are professional officers and have common interests and the welfare of the department at heart. I should say they rather help one another.

4,387. (V.) Decentralization.—Any further decentralization within the Public Works Department is not desirable, as it would lead to more expense and mar

economy. I understand it was once tried by a Sanitary Engineer in this province and found a failure. However, I have suggested that large sanitary works may be left to the direct control of the Sanitary Engineer.

(2). The powers of Executive Engineers and sub-divisional officers to sanction estimates and tenders of contractors and for carrying out works should be enhanced at the discretion of the Committee. I would point out that the sub-divisional officer is the life and soul of the Department. In the first instance he prepares estimates and initiates rates. Secondly, he carries out works and deals with subordinate contractors, workmen and officers of other departments. Thirdly, he measures work done, prepares bills and spends the money directly or indirectly. The Chief and Superintending Engineers are merely bankers and trustees to pass the public money on by means of paper. Consequently the sub-divisional officer should be made a self-respecting officer and beyond all temptations. It is not a businesslike policy to ignore and handicap him.

4,388. (VI.) Simplification of procedure.—The Public Works Department Code has outgrown its legitimate limits and is greatly restrictive, if not unduly so. Its offshoot called "The Manual of Orders" for incorporation in Chapter 11 for financial control (*vide* Secretary to Government, Punjab letter No. 2585-G, dated 30th October 1916 to Superintending Engineer, First Circle) is a fair type to illustrate the spirit of restrictiveness prevailing in the Code (c. f. Annexure A.).

(2). Now on return to the Department after 6½ years' retirement I find that our hands are much more tied and our liberty of action gone than in the good old days.

(3). The Accountant-General, Punjab, exercises much more control in accordance with the letter of the law than the Examiner formerly.

(4). The advent of the changes contemplated in appointing this Committee of inquiry would, *a fortiori*, necessitate the recasting of the Code.

(5). (a). I would recommend increasing the limit of the requisition work from Rs. 200 to Rs. 500. This would reduce the office as well as out-door work resulting in economy.

(b). The sub-divisional officer should be empowered to accept tenders and carry out works up to Rs. 500 on his own responsibility.

(c). The powers of Executive Engineers regarding works may be enhanced as recommended already. The Executive Engineer may also be empowered to sanction survey reports of tools and plant, as he is the chief officer to judge of their condition, and the Superintending Engineer's sanction is only a nominal one depending on his recommendations.

4,389. (VII.) Education.—The system of education imparted in government engineering colleges in India seems adequate, but I would suggest the following further improvements:—

The teaching of pure mathematics and elementary physical science and chemistry should be eliminated from the engineering classes' college course. Students should be duly qualified in these subjects prior to entering the engineering colleges.

(2). In the engineering classes more theoretical as well as practical training should be given to learn the details and use of machinery like various kinds of steam and oil engines, boilers, pumps, steam road-rollers, electric plant, etc., for designing, installing and working machinery for water-works, drainage works, etc.

(3). Some principles of architecture should also be taught to them.

(4). The standard for admission to the overseer classes should be raised to passing the first arts examination of any recognized university or any equivalent examination.

(5). The overseers may also be taught some rudiments and principles of machinery and architecture to render them more useful to themselves and their employees.

(6). In the sub-overseer classes professional *ministries* should also be admitted and taught rudimentary principles of engineering, drawing, estimating, surveying, etc. They should be *bond fide* children of craftsmen, trained

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at home to work with their own hands as bricklayers or stone cutters or carpenters or blacksmiths. Their age for admission may be between 20 and 25 years and they may be awarded scholarships to help them in their studies.

4,300. (VIII.) Practical training.—No adequate provision is now made for the practical training of Apprentice Engineers on works and no one is particularly held responsible or paid any honorarium for interesting himself in their training.

(2). In my opinion first of all the apprentices should be selected for the different branches of the Public Works Department either on the recommendations of the principals of their colleges or according to their own choice or on any other method that government may prescribe, so that they may be masters knowing the peculiarities and details of any one branch and not jacks-of-all-trades. Secondly, they should be trained on the important works of the particular branch they are selected for in progress at the time. Thirdly, they should then be employed and kept on in the particular branch for which they are trained. Transfers from one branch to another should be an exception rather than a rule. For example Rai Bahadur Ganga Ram, C.I.E., your colleague, can be called an expert of the Roads and Buildings Branch, the several Inspectors General of Irrigation, India, as experts of the Irrigation Branch and Colonel S. F. Croster, R.E., Agent, North Western Railway of the Railway Branch.

(3). Subsequently selected engineers who may get a permanent footing in the Department may also be sent to England and other foreign countries to specialize themselves in their own branches of engineering.

ANNEXURE A.

Financial control.

1. It is essential that all officers whose authority extends to sanctioning the execution of works by the Public Works Department should understand the necessity of a strict compliance with the principles embodied in the Public Works Department Code. Appendix 11A to this Chapter contains the more important rules in the Code relating to the preparation of estimates and the execution of projects, and should be consulted by officials of all departments who have transactions with the Public Works Department.

2. It is the duty of the local Government rigidly to enforce the rules and principles which are laid down in the Public Works Department Code, and which are sufficient, if duly observed, to prevent unauthorized excesses, or irregular expenditure.

3. Excess or irregular expenditure is generally due to one or other of the following causes:—

- (i). Commencement of work without an estimate.
- (ii). Defective estimating.
- (iii). Deviations from the sanctioned project.

4. These causes will be dealt in the order stated:—

(i). *Commencement of work without an estimate.*—It is a fundamental rule that the commencement of the execution of any work or expenditure of public funds shall not be definitely authorised by any authority whatever unless a properly detailed design and estimate have been prepared and approved. Executive Engineers are accordingly strictly prohibited by the Public Works Department Code from commencing any work till sanction to it has been accorded, allotment of funds made and orders for its commencement issued by competent authority.

An order to prepare an estimate is no authority for commencement of work.

Cases have occurred where, in a desire to see a scheme in which the head of an administration or department has manifested a strong interest put into immediate

execution, officers of the Public Works Department have countenanced the commencement of work without proper working drawings or estimates. It is essential that all officers having any power to sanction works should equally appreciate the importance of the rule, and should understand that in suggesting or allowing any deviation from it they are not only incurring a serious responsibility themselves, but are placing the departmental officers concerned in a position of difficulty and embarrassment.

This fundamental rule may not be infringed except in cases of real emergency to be immediately reported and explained to the authorities competent to accord administrative and technical sanction.

Occasionally trial pits have to be dug before an estimate for a structure can be framed. A separate requisition or estimate to cover the cost should be prepared and sanctioned, but if the outlay is not likely to exceed Rs. 200, the digging work can be started under the orders of the Executive Engineer in anticipation of sanction.

Cases have been reported by the Accountant-General, Punjab, where a work has been started and the expenditure charged to an estimate unconnected therewith. In explanation emergency has been pleaded or the difficulty of foreseeing the details of the expenditure, and that wrong debit could be removed subsequently by a write-back order when an estimate had been prepared in the light of later experience.

The local Government is obliged to deal severely with officers who add to non-observance of the rule a deliberate evasion or attempts at manipulation to avoid discovery.

(ii). *Defective estimating.*—In the case of defective esti-

C. M. 2376-G., dated 16th August 1909, paragraph 4.

mates, errors are found to be due chiefly to inadequate provision made for materials or labour or both, or an unforeseen rise in the rates. In either case the probability of an excess is soon known to the Executive Engineer. If it is not discovered at the time of accepting tenders for the work the facts are disclosed in other ways, usually during inspection. Actual excesses during construction under particular items of work are shown by the "Register of works" (Public Works Department Code 1202) which is posted as soon as the monthly disbursements have been scrutinized by the Executive Engineer. The Superintending Engineer is kept informed of any probable excesses by a "works slip" (Public Works Department Code, 1306) which he may require to be submitted to him periodically (Public Works Department Code, 275). If the excess is more than 5 per cent. a revised estimate becomes necessary (Public Works Department Code, 675) unless it should have occurred at an advanced stage of the work when it is dealt with in the "Completion Report" (Public Works Department Code, 678). It is the duty of the Superintending Engineer to see that the revised estimate is promptly submitted for the orders of the local Government, and the latter is required (Public Works Department Code, 1030) to acquaint the Government of India with the facts, in the case of estimates sanctioned by the Supreme Government or by the Secretary of State, should the excess be beyond the power of the local Government to sanction. Notwithstanding the clear provisions of the rules reviewed above, it has infrequently happened that the government have learnt of excesses of considerable amount after the expenditure has already been incurred. The occurrence of such irregularities must be held to be due, not to any defect in the rules, but either to a want of their observance by the executive or to a laxity of control on the part of the administrative authorities.

(iii). *Deviations from the sanctioned projects.*—Important

C. M. No. 2376-G., dated 16th August 1909, paragraph 5, Public Works Department Code Nos. 753 and 753-A.

deviations from a sanctioned estimate may not be made without the sanction of the authority competent to sanction deviations. The object of this prohibition is obvious for were it otherwise the Administration would cease to control expenditure.

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Infractions to this rule have been reported, particularly in connection with residential buildings. The prospective tenant has suggested an alteration which is an improvement or an addition possibly omitted by oversight when C. 4-B, dated 17th August 1910, the estimate was prepared.

The suggestion seemed reasonable and the Executive Engineer carried it out but before doing so he should consider whether the expenditure will cause an excess on the estimated amount beyond what is permissible (Public Works Department Code 678). Excuses that the deviations had been made at the request of the departmental officer concerned cannot be accepted, and Public Works Department officers may find themselves called upon to defray such excess charges out of their own pockets.

This refers to a Chapter in the Manual of Orders.

Letter No. 481-B, dated 21st February 1905.

called upon to defray such excess charges out of their own pockets.

5. In certain cases original work on a building has been charged to repairs of that building.

In private builders' businesses where no particular importance or responsibility is attached to the accounts, such methods of convenience might be suitable but in the Public Works Department, where the accounts are intended truly to represent the facts and to be reliable data for the basis of statistics, the Administration expects that officers will either obey the rules of account as laid down in the Public Works Department Code or in any case where the exigencies of special circumstances prevent the strict observance of the rules they will at once report the infraction and the reasons which have led to it.

Cases have been reported where a sub-divisional officer has charged the cost of rebuilding a retaining wall on a hill road to the annual repair estimate and finding subsequently that the annual repair estimate was likely to be exceeded, a special repair estimate was prepared to cover the cost of the work, and a write-back order to remove the excess from the annual repair estimate. The rebuilding of retaining walls is a legitimate charge to the annual maintenance estimate of roads; and if the estimate is likely to be exceeded either a supplementary estimate should be prepared or the excess explained in the completion report.

This refers to a Chapter in the Manual of orders.

Public Works Department Code 671, 711, 783 and 1028.

The procedure of charging temporarily to one estimate with the intention of subsequently charging to another and adjusting the charge by a write-back is not only irregular but unnecessary and clumsy.

Petty original works must either be charged to an estimate specially prepared to provide for them, or if they are required in connection with an original work in progress, they can be charged to the contingencies of the estimate concerned under the limitations prescribed by Public Works Department Code 320(c), and Punjab Government Public Works Department, Buildings and Roads Branch, Circular No. 4-B, dated the 17th August 1910.

On no account should original works be charged to repairs, with or without any intention of a subsequent write-back order. They are distinct heads of account, and must be kept so from start to finish.

Public Works Department Code, 648.

APPENDIX II. A.

Resumé of the procedure in the Public Works Department Code in connection with works executed by the Public Works Department.

(1). *Administrative sanction*.—Administrative sanction prior to technical sanction being accorded must be obtained for works initiated by, or connected with departments, other than the Public Works Department. Such sanction is accorded either by heads of departments and local authorities or by the Government of India in the administrative department concerned if

Public Works Department Code, 610.

beyond the powers of the former authorities. The application for administrative sanction shall be accompanied by a preliminary report, by an approximate estimate and by such preliminary plans, information as to the site and other details as may be necessary fully to elucidate the proposals and the reasons therefor. For works which are estimated to cost not more than Rs. 5,000 detailed plans and estimates may be prepared in the first instance and submitted for administrative sanction by competent authority.

(2). *Technical sanction*.—For all works whether initiated by other departments or by the Public Works Department, the next stage is what is termed final or technical sanction. It is a fundamental principle that no work shall be commenced unless a detailed estimate has received the sanction of competent authority, and proper working drawings and estimates have been prepared. Provision of funds (*vide* paragraph 5) and the preparation of detailed plans and estimates will be arranged for and carried out by the Executive Engineer of the Public Works Department. This done, the authority granted by a sanctioned estimate must always be looked upon as strictly limited by the precise objects for which the estimate was intended

Public Works Department Code, 618 and 1022.

Public Works Department Code, 673.

to provide.

(3). *Revised estimate*.—Deviations from a scheme which result in any material alterations should be reported by the Executive Engineer for the approval of the Superintending Engineer, and if they are of an important nature, the consent of the authority who technically sanctioned the original estimate should be obtained. Should it appear probable that it will be necessary to submit a supplementary or revised estimate, or should material deviations from the original proposals appear likely, even though the cost of these may possibly be covered by savings on other items, a report should immediately be submitted to the authority which has power to accord sanction, explaining briefly the necessity for the supplementary or revised estimate and stating the probable amount of the excess expenditure over that originally sanctioned, followed promptly by the revised estimate. No delay is permitted in bringing the probability of an excess to notice and Executive Engineers are bound to report the fact forthwith to the Superintending Engineer (Public Works Department Form No. 33.) If, however, an excess occurs at such an advanced stage of the construction of the work as to render a revised estimate purposeless, the excess will be dealt with in the form of a completion report. It must however be borne in mind that any excess over a revised estimate sanctioned by the Government of India or the Secretary of State can be sanctioned by those authorities only.

Public Works Department Code, 648(c), 676 A., 783 and 1028.

Paragraphs 275 and 1300.

Paragraph 678.

Paragraph 1028.

(4). *Supplementary estimate*.—Cognate to the revised estimate is the supplementary estimate. Any development of a project considered necessary while a work is in progress, and which cannot be considered fairly contingent on the work as originally sanctioned, must be covered by a supplementary estimate, accompanied by a full report of the circumstances which render it necessary. This estimate must be duly sanctioned prior to the supplementary works being commenced.

(5). *Provision of funds*.—Funds for works, the estimates for which have been duly sanctioned, are provided in the Public Works Department and it is as essential a principle as technical sanction that no work shall be commenced until funds have been specifically allotted for it, and the expenditure should be limited by the allotment assigned as well as by the sanctioned estimate. In reference to work appertaining to, or initiated by, departments other than the Public Works Department, heads of such departments are required

Paragraph 1023.

Paragraph 1875.

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to submit annually to the local Government or Administration concerned a statement of new works which will be required during the ensuing year, but no work shall be entered in this statement that has not been administratively sanctioned (vide Paragraphs 1793 and 1830.

Paragraph 1793. For works in progress no statement is required as such works will have appeared in the statement of a previous year and the local Government or Administration is already in possession of information to enable it to determine what provision is necessary.

(6). *Audit*.—It is incumbent on the Accountant-General immediately to place under objection in periodical statements all items of irregular outlay, i.e. :—

- (i) expenditure incurred without estimate ;
- (ii) expenditure incurred in excess of estimate ;
- (iii) expenditure incurred without appropriation of funds ;
- (iv) expenditure incurred in excess of the funds appropriated ;

(v) estimates which have not received the sanction of competent authority ; and
(vi) miscellaneous irregularities.

Paragraph 1488.

He is, moreover, required immediately to report by special letter, to the local Government or Administration, all instances of irregular expenditure which he considers to require immediate consideration.

(7). *Summary*.—It will, therefore, be seen that the fundamental principles governing the execution of works by the Public Works Department are :—

(i) accordance of administrative sanction to works of other departments ;

(ii) accordance of technical sanction to estimates for all works, either by an original, a revised or a supplementary estimate ;

(iii) accordance of order for the commencement of work by competent authority ;

(iv) provision of funds ; -
and that these requirements must be duly complied with prior to the commencement of a work.

Paragraph 781.

Paragraphs 1022 and 1023.

RAI BAHADUR KANHAIYA LAL called and examined.

4,301. (*President*.) The witness stated that he was a retired Executive Engineer of the Public Works Department and that he was at present temporarily employed in that capacity owing to the paucity of officers consequent on the war. He added that he had received his engineering education at the Thomason Civil Engineering College, Roorkee.

4,392. In his opinion the main drawback in the present organization of the Public Works Department was the dual control exercised by the Department and the district board in one and the same district or station. He considered this should be entirely obviated, and had therefore proposed a scheme in his written statement the basis of which was the establishment of a local works service for each district. Such service would be responsible for all government roads and buildings including those belonging to district boards up to a limit of Rs. 2 lakhs in the case of major district divisions, and Rs. 50,000 in the case of minor district divisions. He had recommended this differentiation as the scheme could not, for a start, be introduced in its entirety. Under his scheme each district would be a complete unit, and the district engineer of one district would not have charge of another. He had also proposed the formation of five Public Works Department divisions, corresponding to the Revenue divisions, with the headquarters of the Executive Engineers at the headquarters of Commissioners, for the construction of large works, and the construction of works beyond the limit of the district divisions would be carried out by the Executive Engineers concerned. Hence the Department would only employ a staff sufficient to undertake the construction of works above the proposed limits. He contemplated that such departmental staff should exercise supervisory functions with respect to works constructed by district boards, since supervision and audit of accounts was absolutely necessary. Major district works should therefore be supervised by the Superintending Engineer, and minor districts works by the Executive Engineer.

4,393. The question whether district boards in the Punjab were sufficiently advanced for the purposes of his scheme was a difficult one. Local boards were created in the time of Lord Ripon in 1885 and no one at that time believed the system would work, but such boards could at present be trusted. The question was one therefore of trust, and if the boards were trusted sufficiently they would eventually prove satisfactory. The members of the boards were not at present selected on sound lines. Some of the people of the district were retired officials who were reluctant to offer their services, but times were advancing. There had, for instance, been a time when no Indian school or telegraph masters had been in existence, but Indians

at present were nominated to the Privy Council. If district boards were given the opportunity, therefore, they would advance, but such advance should be gradual and not too drastic.

4,394. A satisfactory class of men could be obtained as district engineers if they were paid a sufficiently high salary. He here quoted instances in which government buildings and roads had been transferred to local bodies and were taken back owing to their not having been maintained to standard. In 1885 such a re-transfer had been due to the transfer of a highly paid engineering staff to district boards without works of corresponding magnitude. In 1910 again feeder roads had been made over to local bodies without the corresponding government staff. Consequently, the roads had not been kept up to the required standard. He held, therefore, that the system had not been given a proper trial. A money grant had in some cases been given to local bodies for maintenance work and the provision of the necessary engineering staff, but this system also had proved a failure owing to lack of organization. He could not furnish details in this connection but mentioned that district engineers had in some cases been employed on large salaries. The maintenance of the feeder roads in question had as a matter of fact not been altogether a total failure since a certain number of them were still maintained by district bodies, but they had not been kept in anything like such good repair as the roads maintained by the Public Works Department.

4,395. The recruitment of a satisfactory type of district engineer did not entirely depend on the question of pay, but also on organization. Government should therefore formulate a district scheme. They would then be in a position to judge what amount of responsibility the districts were capable of assuming. There were at present 11 Public Works Department divisions in the province. He had suggested the reduction of that number to 5, allocating the remaining 6 to first-class district board divisions to which government would either lend the services of Public Works Department officers to commence with, or charge the pay of such officers to the district establishment. This, however, was a matter of finance and could be dealt with by a finance committee. All the large district divisions should be manned by district engineers and the smaller divisions by trained upper subordinates. Several Deputy Commissioners at present expressed dissatisfaction with the manner in which works were being constructed by their engineers. Hence by sending Public Works Department officers to such districts to commence with, works would be carried out in an efficient manner, and when the district engineering staff were eventually efficient enough they could be entrusted with the execution of their own

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work. The district board would exercise administrative control over the executive staff thus placed under it, but technical control over such men should be exercised by the Superintending Engineer and Chief Engineer. In other words the district board should have no powers over the executive staff except in regard to matters of finance and administration. When district boards had become sufficiently advanced, their powers should be gradually enhanced so that they would eventually become independent.

4,396. He had suggested in his written statement that the proposed local works service should be of a permanent non-pensionable character. He personally did not prefer a provident fund to a pension because he received his pension monthly or quarterly and lived upon it, whereas if he had been given a lump sum on his retirement he might have squandered it. For this reason, therefore, all subordinates should be pensionable. Otherwise, there was not sufficient inducement for them to stick to the Department and work honestly.

4,397. He considered that the scale of salaries of upper and lower subordinates should be increased as the prices of commodities were extremely high at present compared with what they had been half a century ago. He did not mean to imply that the class of subordinates at present recruited to the Department were not efficient, but that if they were not paid a sufficiently high wage they would obtain employment elsewhere. The class of subordinate at present employed by the Department was as a matter of fact better than that formerly recruited as the education now given in the Roorkee College was superior to that given formerly.

4,398. He emphasized that sub-divisional officers were the pivot of the Department, and that they should be entrusted with larger powers.

4,399. He had proposed in his written statement to augment the lower subordinate class by the introduction of sub-overseers of the *mistri* class on a permanent basis as *mistris* were at present employed on a temporary footing. Consequently, their standard of honesty was rather low, and if they were placed on the regular establishment they would consider themselves as holding some position and work honestly and efficiently. If *mistris*, several of whom had been educated up to the middle school standard, were sent to learn their work and a little English at a college they would prove more useful. It was necessary that they should also be taught surveying to enable them to take levels.

4,400. There were no large engineering and contracting firms in the Punjab, but only a few fairly large contractors who had been working for the Department for the past 70 years. All Public Works Department work should invariably be given out to contractors under proper supervision and audit. The amount of supervision at present exercised by the Department was too excessive as contractors were more or less illiterate; their bills were prepared for them and they really did not know whether they were correct or not. If retired subordinates, etc., would, however, commence business as contractors there would be no necessity for the amount of supervision exercised at present; similarly the amount of supervision should be reduced in the case of reliable contractors, otherwise no economy would result. Economy could be secured in the construction of a rest house, for instance, for which tenders had been invited, by accepting the tender of a retired supervisor or a man who thoroughly understood his work. In such a case the periodical supervision of a sub-divisional officer or district engineer would only be necessary and there would be no necessity for employing a whole-time *mistri*. Although the tender of a particular man might be a little lower than that of another tenderer it did not necessarily follow that the former should be accepted, and such a condition was laid down in all tenders. As a matter of fact, he generally accepted, or recommended the acceptance of, a tender submitted by a man at 1 per cent. less than the schedule of rates rather than that of a man at 4 per cent. less as the latter would be sure to give trouble.

4,401. The Executive Engineer at present had powers to accept tenders up to Rs. 5,000 and this limit should be increased to Rs. 10,000 or more. Payments by sub-divisional officers were at present made only by those men who held cash books and had drawing accounts. All sub-divisional officers in charge of sub-divisions away from headquarters were allowed drawing accounts, but this did not apply to such officers when serving at headquarters. Sub-divisional officers should have power to accept tenders up to a certain limit as they know more about the contractors of the district than the Superintending or Chief Engineer.

4,402. Executive Engineers should have the power to dismiss lower subordinates subject to appeal to the Superintending Engineer, as they could always judge whether a man was or was not fit for employment in the Department. The question whether lower subordinates would always receive fair treatment from Executive Engineers depended on the personality of the particular officer concerned.

4,403. Students of the Roorkee college should, when appointed to the Department, undergo a course of practical training in the branch for which they were most fitted. From his experience in the Department he felt that if an irrigation officer had to undertake his work, such officer could not master all the details as well as himself as he had worked as an Assistant and Executive Engineer and was therefore fully acquainted with all the necessary details and the work of contractors.

4,404. (Mr. Cobb.) Lower subordinates drawing Rs. 30 a month were certainly under-paid. Their salaries should, therefore, be increased to Rs. 50 a month to commence with, rising to Rs. 130. He was emphatically opposed to the view that if lower subordinates were paid a wage of Rs. 50 a month they would accept bribes of correspondingly larger amount. He added that lower subordinates should not be called upon to undertake more work if their pay were increased as a man could not possibly do two men's work simply because he was paid a better salary. For example, when he joined the Department, the pay of the Executive Engineer was Rs. 950 a month whereas the pay of that officer was at present Rs. 1,250 a month, and he was certainly not performing a proportionate increase of work.

4,405. District boards received a sufficient number of applications from candidates to enable them to make selection for their engineering appointments but the question whether or not these boards would agree to his suggestion that government should transfer the services of some of their officers to the boards could only be answered by a trial of the experiment of amalgamating the two services.

4,406. (Rai Bahadur Ganga Ram.) The age for admission to the Roorkee College should be between 18 and 22 years and should not be reduced to 19 years as the present standard of education in an engineering college was of a high order. Indian boys at the age of 19 were not sufficiently advanced to understand applied mechanics and engineering designs and their brains were too undeveloped to undergo such training. Instead of lowering the standard of admission for Indian students, the standard should be raised for the admission of European students.

4,407. (Mr. Mackenzie) If a petty contractor were employed on the construction of work he might be content with a profit of 5 per cent., but if a large contractor were employed he would require a margin of 10 per cent. as he would have to employ his own *mistri* and *munshi*. A large European contractor would require a still larger margin of profit.

4,408. The services of the Executive Engineer could not be dispensed with if sub-divisional officers were trusted more than they were at present, as the latter were concerned only with a small number of works whereas the Executive Engineer was in charge of perhaps 20 works and 5 or 6 sub-divisions.

4,409. (Mr. Aikman.) If roads were handed over to local bodies the tendency would be to starve them and to utilize the money earmarked for their maintenance on hospitals and other buildings. But if the boards were

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well organized, and supervision was left in the hands of the Superintending Engineer matters would improve. The main drawback at present was the absence of supervision by Public Works Department officials since no one inspected roads.

B. M. SULLIVAN, ESQ., A.R.I.B.A., Consulting Architect to the Government of the Punjab.

Written Statement.

4,411. In presenting this memorandum to the Committee of Inquiry I would like to state that I have not dealt item by item with the eight points given in the terms of reference, as, in discussing one point, it seems necessary to bring in others related to it. I have therefore treated, as a whole, those points which have come under my observation in the execution of my duties. The views advanced are put forward with diffidence as I have only been in the country some 3½ years and of the difficulties under which I laboured at first many have been removed as the ordinary sphere of an architect has become more widely known.

4,412. The Consulting Architect's duties in this province consist of designing works in their entirety—lay out of districts, town-planning improvements and all classes of buildings, from bungalows to secretariats—from the small scale drawings to the full size details. Besides this he acts as a consultant, primarily to the Buildings and Roads Branch, though great and increasing use is made of him by other departments, such as the Irrigation Branch, the Police, Educational and Medical Departments. No obstacles are put in the way of departments, other than the Buildings and Roads, approaching him direct. He visits works under construction from his designs to advise the engineer, *but he has no power to give orders either to the engineer or to the contractor.*

4,413. He is employed on a five years' covenant. He was appointed by the Secretary of State who laid down that he must be between thirty and forty years of age. He is a member of the Royal Institute of British Architects and held responsible positions in England, besides carrying out works in private practice there. He is thus a trained man, conversant with the design and construction of buildings from commencement to completion.

4,414. His designs are carried out by Executive Engineers of the Buildings and Roads Branch of the Public Works Department who prepare the estimates, receive tenders for the work, arrange for payments to the contractors, measure up at completion and are generally responsible for the proper execution of the work.

4,415. The engineers are recruited from England or India at about the age of twenty-three. They have no knowledge, until the last moment, whether they will be attached to the Irrigation or the Buildings and Roads Branch. Those brought from England come with no experience of building works beyond what they have learnt during a period of some months' practical training. This short period is frequently spent on work of a type which they will not be called upon to do in the Buildings and Roads Branch. Never, in my experience has the time been spent as a clerk of works or in some similar capacity with an architect or building contractor where actual building work and methods may be studied. Again, I know of no case in which the course of instruction includes the study of the principles underlying quantity surveying as carried out in Europe, though the engineers frequently commence work in this province by measuring up works, etc., on which measurements payments are made to contractors. The result is that the engineer cannot have a thorough knowledge of the work which he will be called upon to do, and what he is able to learn must be obtained in this province where reinforced concrete is practically unknown, and the plastering, brick-laying, plumbing and carpentry trades are at a low ebb. The student in training as an engineer in the Punjab, is more unfortunate as he has nowhere to turn to see workmanship anywhere approaching the European standard.

4,410. He had in his written statement objected only to the restrictions imposed in the Public Works Department Code itself; not to the Manual of Orders which was only of a subsidiary and explanatory nature.

4,416. The engineers hold (with the exception of about four) permanent and pensionable positions. They commence as Assistant Engineers and rise through the grade of Executive Engineer to that of Superintending Engineer. The Chief Engineer, who is head of the department, is selected from the ranks of the Superintending Engineers of either the Buildings and Roads Branch or the Irrigation Branch.

4,417. The Assistant Engineer is subordinate to the Executive Engineer who, in his turn, is subordinate to the Superintending Engineer. Both the Superintending Engineer and Consulting Architect are subordinate to the Chief Engineer.

4,418. It will be seen from the preceding notes that while the Consulting Architect is a highly trained man, necessarily brought from England fairly late in life, the engineers are sent out much younger with little practical training in the execution or estimating of building works and small chance of coming into contact with anything but the somewhat primitive methods of this province. Although this is so, the Consulting Architect has no control at all over the execution of the work from his designs, though he is fully qualified to exert it and invariably does so in England. Besides this, and in spite of his long and expensive training at home, the Consulting Architect's position is temporary and not pensionable. The results are unsatisfactory as described below.

4,419. The Consulting Architect in visiting a project under construction from his design may point out deviations from it or from his specification, for instance the damp proof course may have been omitted or another used, of a type he has not specified, and which he cannot approve. He may point out careless or bad workmanship, incorrect setting out, etc., but he has no means of enforcing greater care or better workmanship upon the contractor, nor can he galvanize into action a stagnating overseer, as the overseer knows that his prospects for good or bad do not depend upon the architect in any way, but upon the engineer. Besides, an engineer full of energy and with the best intentions is unable to be conversant with a high standard of work for the reasons given in paragraph 4,415. Again, inspections of buildings in progress from the Consulting Architect's designs may be made by the Chief Engineer or the Superintending Engineer and orders may be passed on it in the Consulting Architect's absence and without his knowledge. It also happens that the Consulting Architect is asked to prepare schemes when many important points have already been settled and he is tied by conditions which might have been avoided had he been consulted earlier. Again the engineers may take schemes prepared by the Consulting Architect to lay before committees at which the Consulting Architect is not present. In such cases drastic alterations may be decided upon in committee which, had the Consulting Architect been present to give advice, would probably not have been adopted. The only remedy, in most of these cases, which the Consulting Architect has, is to complain to the Chief Engineer who in dealing with complaints is not only hampered by not knowing what constitutes a satisfactory standard of work from an architect's point of view, but he cannot usually visit the work and go into the matter personally as he has many other matters of his department to deal with. In cases where the Consulting Architect might desire to object to orders passed on his designs by the Chief Engineer himself, the Chief Engineer would be judge as well as defendant. The importance of this may be understood when it is remembered that it is largely on the Chief Engineer's recommendation or the reverse that the Consulting Architect holds or loses his position.

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It follows, therefore, that even the most energetic architect, intent on getting good work, will be chary of complaining too frequently. From the above it is clear that when the design has left the architect's office, he becomes practically a negligible factor, whereas this is just the time when he should be in control of the work. And, though his hands are so tied, he must be prepared to suffer all adverse criticism levelled at the completed building or scheme. Again, although the architect finds it necessary, in designing a building, to work out the steel-work, thickness of walls, etc., and to prepare an estimate, it is done over again by the engineers who are responsible for the stability and cost of the buildings. The Consulting Architect, knowing this, does not carry it out in the detail he otherwise would; but it would be very little extra work for him, instead of the engineer, to do so which would be an advantage as besides saving duplication, he is naturally more conversant with his own design than an engineer coming freshly to it. Again, a scheme is frequently worked out by the engineers in full drawings, specifications and estimates and then sent to the architect who finds it necessary to make a fresh start, which causes delay and expense which would have been avoided if the scheme had gone to him in the first place.

4,420. Regarding the question of giving out work to contractors I do not see how the present method is to be improved upon. Work is already largely given out, but as the contractors are little more than collectors of labour, government finds it necessary to supply them with plant such as winches, derricks, wire ropes, etc.

4,421. *Suggestions for improvement.*—Engineering and architecture should be divided into separate departments, the engineers concerning themselves with roads and bridges and the architects with buildings. This would permit of the engineer being able to concentrate on his profession instead of, as at present, being compelled to act alternately as an architect, builder, clerk of works, quantity surveyor, sanitary engineer, bridge builder, road surveyor, accountant, etc., etc.

(2). The engineering side should also have experts in sanitation, electricity and reinforced concrete attached to it.

(3). The Indian engineering colleges should provide a high standard of training for engineers desiring to enter private practice. Government could hand over work annually to such trained men, the amount being steadily increased. In course of time, as this system proved itself, the engineering establishment of the Public Works Department could probably be gradually reduced until it became a small body of experts.

4,422. In the Architectural Department the following method might be adopted:—

Architectural schemes should be divided into two heads—capital and district. Capital works would include all works in Lahore itself. District works all those outside Lahore.

Capital works.—Buildings of architectural value and lay-out schemes costing half a lakh or more should go to the Consulting Architect's Department, as well as any smaller scheme which owing to its intention or position might be of architectural importance. He should be entirely responsible for the design, specification, estimate, supervision and final completion of the work. He should call for tenders and submit them to higher authority with his recommendation. The selected contractor, as well as the clerk of works (discussed later), should be answerable to him and under his orders. He should issue certificates on the Accountant-General to the contractor for payment as the work progressed and should measure up, value and issue his final certificate on completion. In short, he would carry out his duties from start to finish, exactly as he does in England.

District works.—All buildings of architectural value and lay-out works costing over one lakh should come to him and he should be entirely responsible for the design and complete execution of the work as already described for capital works costing over half a lakh.

4,423. *Capital works of under half a lakh: District works of under one lakh.*—Architectural works of under

half a lakh in the capital or under one lakh in the district would be divided among local boards and private practitioners.

4,424. In order to train private practitioners the Mayo School of Art, Lahore, should institute a proper course of training for architectural Assistants desiring to enter private practice, devised and controlled by a qualified professor of architecture. In course of time there should be a college devoted to the study of architecture from which students could take the examinations of the Royal Institute of British Architects or sit for a degree of Bachelor of Architecture of the Punjab University. This would be somewhat similar to the method followed in England. Government should annually hand over works of under half a lakh in the capital and under one lakh in the district to such properly trained men. But before the trained architects come into existence this work should be carried out by the existing Buildings and Roads Branch and the local boards. So long as the Buildings and Roads Branch continues to carry out building works I would suggest that its recruits should come out to this country a year or so later than they do now, having been—after they have finished their theoretical course—attached to the Office of Works, London County Council, or to the staffs of selected building contractors in order to learn practical building methods.

4,425. To equip the Consulting Architect with an efficient establishment to take over the work specified in paragraph 4,422, his establishment should contain properly trained English assistant architects, besides draughtsmen, estimators, accountants and clerks. He should be subordinate to the authority placed at the head of the specialists. If he remains subordinate to the Chief Engineer he should hold the rank of Superintending Engineer as head of the Architectural Department. But it is most important that the Consulting Architect should have sole control over the design and execution of the work once it has been put into his hands by superior authority for execution. The Consulting Architect should design his work, either in the capital or district, in direct consultation with the body for whom it is intended, who would give approval of the design before it could be put in hand. In order that he should hold a position commensurate with his attainments and the importance of the position he holds he should be on a permanent footing and receive the pay of a Superintending Engineer; but so that the local Government may make sure that they have obtained the type of man they want he should be on probation for a term of years—say three—by which time a considerable amount of his work will have been built and can be judged. During this period he might receive the pay of a senior Executive Engineer. (This is probably the least that would attract a fully trained man, between thirty and forty years of age to leave England).

4,426. On his staff should be four clerks of works who would each be employed on one or more buildings in progress. At the commencement it is important that these men should be properly trained clerks of works from England. Each of them could be made responsible for the training of one or more Indian clerks of works. Thoroughly efficient clerks of works could probably be obtained from England for about Rs. 350–400 per mensem. A system might be devised by which clerks of works from the permanent staffs of the Office of Works, London County Council, or similar English bodies could be lent to the Punjab Government for a term of years at somewhat increased pay to that given them at home. These positions would probably be popular, and the possibility of being promptly returned to England with a bad report would keep them up to the scratch. Their duties would be exactly what they are in England, i.e., to set out the work, watch it constantly while in progress, see that the specification and drawings are adhered to, compel a proper standard of work, bring irregularities to the notice of the architect and generally keep the contractor up to the mark. In order to improve the building trades and methods of working in the province, the Consulting Architect should also have temporarily attached to his department four working foremen of the brick-laying, plastering, plumbing and carpentry trades.

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These men would be sent from building to building, as their particular trade was taken in hand, to show the local *mistris* the best methods of working. They should be recruited from the staffs of contractors in England, and it should be made clear to them that they would be expected to take off their coats, set the pace, supervise the work and generally carry on exactly as at home. They should be on temporary appointments

paid at about Rs. 250 per mensem. There would be no necessity to keep them on for many years as the local *mistris* is very quick to learn once he is shown. (There is no one at present who can show them improved methods as the subordinates of the Public Works Department in the Buildings and Roads Branch have not got the knowledge.)

MR. B. M. SULLIVAN called and examined.

4,427. (President.) The witness stated that he was the Consulting Architect to the Government of the Punjab and that he had held the appointment since January 1914. He had been recruited in England on a five years' agreement terminable with six months' notice on either side.

4,428. His duties were defined in a set of rules which had been drawn up for his guidance, and consisted in the preparation of designs for civic improvements and buildings both large and small.

4,429. The quantities and estimates of rates were worked out by the engineers, but it was necessary for him also to work out estimates for the buildings he designed for his own information. It was not of much consequence who prepared estimates and quantities as long as the officer who did so was qualified and worked in close consultation with the Architect. The engineer, not being an expert and not in close touch with the Architect, might put items in the estimate which the Architect did not desire and, on the other hand, might leave out items which were desirable from an architectural point of view.

4,430. Designs prepared by engineers in the Public Works Department were sent to him for scrutiny. Such a procedure served a useful purpose, as he very rarely received designs which could not be improved upon with regard to orientation, arrangement of accommodation, and cheaper methods of construction, etc. The scrutiny by him of plans which had been prepared by engineers was no light matter, but it was certainly worth doing as an Architect could, at least, supply the engineers with sketches and notes showing where improvements could be effected. The present procedure of scrutinising the engineers' designs absorbed a good deal of his time, but although it did not result in the construction of ideal buildings it prevented flagrant incongruities and led to improvements.

4,431. He had occasionally received large elaborately worked out schemes for scrutiny and had felt obliged, on some occasions, to suggest an entire recasting of them. He stated that engineers did their best in the preparation of designs for buildings but not being trained designers great results could not be expected.

4,432. Executive Engineers could not be sufficiently skilled in the design or construction of buildings as they were required to undertake many different classes of work and did not specialize in any one of them as was the case with the Architect. An engineer might for instance be in charge of divisions for years in which the major portion of his time was occupied on road and bridge work, after which he might be put in charge of the design and construction of important buildings.

4,433. He was opposed to the view that it was necessary to attach an engineer to the office of the Consulting Architect as he was of opinion that the latter officer was perfectly capable, with proper Architectural Assistants, of being placed in sole executive charge of the construction of all buildings of importance in his province.

4,434. Engineering and architecture should be separated from each other, the engineers concerning themselves with roads and bridges and the Architects with buildings. The Architectural Branch should take over the design and construction of all major buildings of architectural value in Lahore, the estimated cost of which was more than Rs. 50,000, together with any smaller scheme which, owing to its intention or position, might be of architectural value. Buildings costing less than Rs. 50,000 should be carried out by local boards and private practitioners. In his opinion, the Architect should not be responsible for the maintenance of buildings he had constructed. The Architect should be in immediate

charge also of the construction of all buildings in the district which cost more than Rs. 1 lakh. He believed, however, that their number would not be great and was inclined to the view that most district buildings came more within the scope of the engineer than the Architect, e.g., grain elevators and similar buildings. He did not contemplate the employment of a resident Assistant Architect for the supervision of district buildings which exceeded Rs. 1 lakh. A whole-time clerk of works would be engaged for each building, which would be periodically inspected by the Consulting Architect or his Assistant Architect, the employment of Assistant Architects depending on the total amount of work in the Consulting Architect's office.

4,435. He approved of the proposal to recruit quantity surveyors from England, as he considered it would improve the standard of estimating in India and lead to economy, inasmuch as such men would by reason of their training be able to work out the estimated cost of buildings and measure work scientifically.

4,436. Although quantities were a guide to contractors they were naturally useless to such men unless they were capable of understanding them. A quantity surveyor would not be able to do anything in the direction of reducing rates at different sites of work, but he would prove very useful in estimating because he would be in possession of all rates of all localities. It was true that a schedule of rates was maintained at present and this was revised by the engineers periodically in the light of the latest local knowledge available.

4,437. He knew of a case where an engineer had to make his own schedule of rates as the circulated schedule of rates did not apply to the place where he was. There would have been no necessity for such a course, had a quantity surveyor been in existence at the time, as the required information could have been obtained by reference to that officer.

4,438. He had recommended in his written statement that four clerks of works should be recruited from England on a salary of between Rs. 350 and Rs. 400 a month and that they should be attached to the staff of the Consulting Architect. He knew that men of this class in England were in receipt of salaries ranging from £2-10-0 to £5-0-0 a week. It was possible that the Office of Works, or the London County Council, might be able to lend the services of such men from their permanent staffs for a term of years and they could be returned if they were badly reported on. Clerks of works could not be obtained from among Indians unless they were first trained by efficient men recruited from England. The ordinary subordinate who was at present recruited for the Public Works Department could, however, be satisfactorily trained for the supervision of buildings by a clerk of works from England. Although a large number of important buildings had been constructed in India and several were in course of construction at present, he considered it was necessary to recruit the class of men he advocated because a comparison of buildings in Europe, which had been supervised by a clerk of works, with buildings in India which had not, disclosed the fact that none of the latter approached the constructional finish of those of Europe.

4,439. He had also recommended, in order to improve the building trades and methods of working in the province, that the Consulting Architect should have temporarily attached to his department four working foremen of the brick-laying, plastering, plumbing and carpentry trades as his experience of these trades in the Punjab had been that they were generally at a low level. The joinery of the province was excellent and the carpentry

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moderate, but no great knowledge was shown of brick-laying and the pointing of brick-work or the scientific use of mortar as understood in England. The workmen did not understand the use of reinforced concrete. His scheme contemplated a fair percentage of new European establishment but a large diminution of the European engineering establishment. He considered that the increase was necessary at the commencement in order that the working foremen might be sent from building to building as their particular trade was taken in hand, to teach the local *mistris* the best method of working. He had not estimated the expenditure entailed by his scheme but thought that as the cost of the construction of civil buildings in the province amounted to about Rs. 24 lakhs a year of which about Rs. 15 lakhs represented the architectural work, a large staff would not be required. It was here pointed out to the witness that the construction of large works amounted to about Rs. 5 or Rs. 6 lakhs a year only, and he admitted that if that were so the system he proposed might be somewhat expensive to commence with.

4,440. Architects recruited for government service in India should be members of the Royal Institute of British Architects as it was desirable that such officers should be fully trained. It was further desirable that such men should possess a certain number of years' experience as working Architects. He would therefore recruit them between the ages of 30 and 40 years. The earliest age at which an Architect passed his final examination was 21. He would thus have attained a good deal of experience in private practice by the time he reached 30 or 40 years of age. He was also of opinion that Architects should be brought out to India on probation for a term of years and that they should be made permanent in cases in which they had worked satisfactorily. With regard to the contention that, owing to the nature of the architect's profession, permanent service removed a very desirable stimulus and had a deadening effect, he was of opinion that such an effect could be produced in a man of any profession—it was a matter of character. In his opinion an Architect would be capable of executing better work if he were not worried by the consideration that his services might be terminated with six months' notice. Apart from this, if Architects were aware of the fact that they ran a grave risk of having their services terminated after a certain period they would require larger salaries, and it would possibly prove difficult to recruit such officers.

4,441. He was in favour of Assistant Architects being recruited on a temporary footing at first, and thought that such officers would accept appointments for a specified term of years. Architects were attracted to government service in India because they knew they would be recruited on a five years' agreement on a reasonable salary and that they would have greater chances of designing important buildings than in England. He did not think, however, that the possibility of having large buildings to design in India would be an inducement to good Architects to come out for a short period of years to acquire knowledge and experience and then return to England.

4,442. The question of the status of Architects did not arise in England as it did in government service in India. He had observed in India that the opinion of a government official carried more weight if he was a permanent official. For the reasons given in his written report it was natural that the Architect should desire to be a permanent official. He recommended that the scale of pay of Architects should be regulated by that of the permanent scale of the Public Works Department.

4,443. He himself could take up private work with the sanction of the local Government. He would prefer that the rate of salary to be fixed should not include such work, and that the local Government should be at liberty to call upon the Architect to undertake any work whenever necessary as part of his ordinary duties. His objection to private work was that permission to do it could be given or withheld more or less arbitrarily and that if any question arose, such as that of delay

in execution of government work, the delay might be ascribed to the private work the Architect was doing.

4,444. He favoured the establishment of a school of architecture for the training and recruitment of Architects in India and considered that Indians made excellent architects, as they were equipped with artistic ideas; but they should be trained, in the first instance, by experienced architects. A school of architecture had been established in Bombay but he did not think it professed to cover the whole of the ground. It turned out excellent draughtsmen who would make good architects if they could afford to go to Europe for study. Some of the passed students of this school were at present employed in his office and were quite satisfactory.

4,445. He believed that when an English architect was required for government service in India, the President of the Royal Institute of British Architects received notice of the fact from the Secretary of State for India. Nomination papers were then sent round to each Vice-President of the Royal Institute of British Architects, of whom there were four, each of whom submitted two or three names. The President of the Institute then examined the qualifications of the men nominated, after which he forwarded his selections to the Secretary of State for India who, in turn, asked the nominees in rotation whether they desired to take up the appointment. He had not up to the present heard of any difficulty that had been experienced by Indians in having their names put forward. The fact that such appointments were of a temporary nature would be detrimental to recruiting if the men knew the conditions under which they would work on arrival in India. They did not come out without knowing roughly what would be required of them but they had no knowledge of the fact—until in India—that the engineers with whom they worked, although not so highly trained, had better terms of service together with a pension. He himself came out to India because of the chance of designing large buildings and he intended to stay on if he liked the country. Hence he did actually contemplate the possibility of long service in India, because he hoped that after five years he would have proved his value and government would ask him to stay on.

4,446. (Sir Noel Kershaw.) He had been trained for his profession for a period of five years. He adhered to the view that it was preferable to recruit Assistant Architects on a temporary basis at first and had little doubt that men would come forward for these appointments. No difficulty had hitherto been experienced in connection with the recruitment of Architects as far as he knew and the difficulty would be no greater in the case of Assistant Architects. When Architects came out to India they found that the conditions were not so good as those of the engineers and hence felt that they suffered under a grievance. He agreed, however, that it might be better to wait, before consideration of the question of permanency, until there were definite signs that Architects would not come out as temporary men.

4,447. He advocated that, when engineering and architecture had been divided into separate departments, the engineering branch should have an expert in ferro-concrete attached to it. He would not consult such an officer, except in the case of large buildings, as in simple ferro-concrete work, for example a floor, it would be a simple question of calculation and not at all abstruse. When the calculation became complicated in, for instance, the construction of a dome or a concrete roof he would consult such an expert. Ferro-concrete was used a little for floors in the Punjab but he would like to see it used also in the construction of roofs, etc.

4,448. He was not aware whether in connection with the measurements of buildings mistakes occurred as frequently against the contractor as in his favour, but thought that a man who had been trained in quantity surveying would naturally be much more accurate than an untrained man. For example if a practised hand measured road metal he would not make a mistake of 100 yards but an unpractised hand might. The latter, however, might make mistakes both ways and there was no reason

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why he should not make a mistake against the contractor any more than against himself, except that the contractor would probably be more on his guard against such errors against himself, as a gain or loss affected his own pocket while it did not affect the engineer one way or the other.

4,449. Again, the contractor would study each little point of the accounts of his two or three contracts while an engineer would be dealing with many in his division and would not have the time or the inclination to go so minutely into each contract. Although he was not concerned with estimates for buildings, he did not agree with the view that contractors were so ignorant that they did not understand quantities and prices and that the latter had to be put in to enable them to judge whether they would be in a position to construct a particular building at a percentage below, or within the estimate. He thought such men were quite intelligent enough to know whether conditions were against them.

4,450. (Mr. Mackenzie.) If a ring of contractors were formed against him he would resort to departmental labour.

4,451. An architect probably expressed in his designs his own feelings and the power to do this was governed by the training he had received, and he was convinced that it was almost impossible for a European to express the feelings of the Indian in architecture since the oriental mind differed so widely from that of the western races. It should be the aim of architects to encourage indigenous architecture to the utmost and to train up young Indian architects if it was desired that India should express herself in architecture hereafter as she had done before. This could be best attained by obtaining Assistants in India wherever possible and not from England. There were no first-class architectural schools in India at present, as compared with those in Europe. The practice was, he believed, for young men desirous of becoming architects to go to England for the purpose. Only draughtsmen were at present turned out by the architectural school in Bombay, but there was no reason why students should not receive a good architectural training in that city.

4,452. A student could receive a training in architecture in a post-graduate class of an engineering college after the completion of a short engineering course, provided the instructors were professors of architecture. On the completion of his architectural training he could then undergo practical training for two years by entering an architect's office and working his way up. He himself, if in private practice, would be prepared to employ such men as architectural assistants in his office on payment of a premium as was the practice in England. If government were prepared to give such training free he would make useful men of them within six to twelve months.

4,453. (Rai Bahadur Ganga Ram.) It would be possible to create private practice in architecture in India if government undertook to hand over work to men who had received an architectural training in a post-graduate class attached to an engineering college, by which he meant properly qualified architects.

4,454. If, after five years' service, government gave him a retaining fee of 2 per cent. for designing all their important buildings, he would in a short time probably be in a position to retire as a rich man. It was as a matter of fact much cheaper for government to pay him a salary.

4,455. Plaster was used on buildings in Lahore because the brick-work in that city was of a poor standard on account of the presence of saltpetre. There were defects in the burning of bricks and their colour was unsightly. He was in favour of the use of stone in place of brick for the construction of buildings but as stone was not available the next best substitute, plaster on brick-work, was used. This if properly applied stood extremely well. Stucco plaster for instance had stood well for many years on buildings in England and so did plaster work in India if properly mixed and applied.

4,456. It had been intended to use Indian tiles on the Medical College in Lahore and inquiries had been made in this connection in Multan but without success. If such tiles were procurable and were satisfactory he would certainly use them.

4,457. (Mr. Cobb.) The engineer was at present responsible for the plaster work in a building but he considered that the Architect should be responsible for such work.

4,458. The drawback in connection with the status of an Architect recruited from England for government service in India was that while an engineer came out to the country at an earlier age, the Architect remained in England until he had acquired a complete knowledge of his profession and this he thought put him on the same level as an engineer as regards the time the latter had spent in India. But when he became associated with the engineer in India he found that officer in a very much better position as regards pay and pensionary prospects.

4,459. He was not aware of any cases where considerably larger quantities of material had been paid for than were actually used in the construction of buildings which he had designed and which had been constructed by an engineer. He was not an expert in quantity surveying and if a quantity surveyor were employed the Architect would not suggest rates; he would merely specify the particular material that was to be used.

4,460. He strongly agreed with the view that the temporary employment of Architects recruited from England caused the absolute loss of their clientele in England; that they would, as a matter of fact, on return to England, after serving five years in India find that they would have to start again. He did not think that any name they had made in India would be of great use to them on their return to England.

4,461. (Mr. Aikman.) With regard to the passage in his written evidence that "in cases where the Consulting Architect might desire to object to orders passed on his designs by the Chief Engineer himself, the Chief Engineer would be judge as well as defendant," he was aware of no case in which the present Chief Engineer had altered or interfered with his designs.

C. C. T. EASTGATE, ESQ., M.L.E.E., Electrical Engineer and Electric Inspector to the Government of the Punjab.

Written Statement.

4,462. *Status and stand-point of writer.*—In submitting the following memorandum, I would wish to first put forward a few details of the experience I have had in India and of the stand-point therefore from which I put forward my opinions on the questions to be taken up by the Committee so far as they concern electrical work. I came out to India in 1903 as Electrical Engineer to the then agents of the General Electric Company of London which agency was in 1912 transformed into a branch of that Company. I joined the branch as a joint manager of the Indian business, and remained in that position until 1914, when I left the service of this Company. During this period of 11 years I was engaged in carrying out electric works all over India, chiefly for government departments and I speak therefore from the point of

view of a firm of consulting and contracting engineers, as well as that of a government electrical officer. I was sent out by the Secretary of State as electrical officer to the Punjab Government early in 1916. I officiated as Electrical Adviser to the Government of India from November 1915 to October 1916, and I am at present officiating as Electrical Engineer to the North Western Railway for the period of the war, in addition to my other duties.

(2). In my present appointment I am partly a Secretariat and partly an executive officer, and in the latter capacity I carry out all original electrical works which come under the Buildings and Roads Branch of the Public Works Department. I am also responsible for their upkeep and repairs. My office is attached to the Chief Engineer of the Buildings and Roads Branch,

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and only deals with Superintending Engineers in matters which concern accounts. I will take up the further duties of my position under the question of the relation of my department to others in the Public Works Department.

4,463. (I.) Economy and suitability of methods of execution of public works, and (II.) Encouragement of other agency.—I will take up *serialim* the special points to be inquired into by the Committee, as far as they concern electrical work in this province, and generally, as far as my experience goes, all over India. The first of these deals with the methods at present adopted for the execution of civil works. As regards electrical works I invariably put out to tender and have executed by private contractors all original works, except those of a petty nature. These have to be executed to a rigid specification issued by me and are subject to my inspection during their execution and on their completion; in some cases they are required to be inspected and passed at a certain stage before the work is allowed to proceed. In every case the contractor has to guarantee his work for a year, and has to replace free of charge any work which may prove defective during this period. His final bill is paid in full on completion, but he is bound by agreement to this maintenance for a year. Maintenance of all electrical works when completed is carried out departmentally by means of a staff attached to my office, the carrying out of which implies keeping stores for replacements and a small workshop for making renewals when necessary. These methods are, I consider, certainly the best to follow under the conditions which prevail in the Punjab both for efficiency and economy, for reasons which I give in the following paragraph.

(2). In my opinion private enterprise should always be able to carry out original works more cheaply than departmental agency, seeing that among other reasons they have not to keep the cumbrous system of accounts which is required in the Public Works Department. The accounts work in my office, which under the Public Works Department system requires three clerks, would be easily done in a business firm by one man by a simple system of ledgers. In my business career the accounts of many times the value of what is handled yearly in my present office were kept by two men.

(3). It will be noted from the preceding paragraph that private enterprise is under the present conditions sufficiently encouraged as far as original works are concerned, in so much as practically all original works at present are carried out by such agency. I am certain that it would never be economical to carry out such work departmentally, as original works would rarely be carried out in such a way as to keep a staff of skilled men constantly employed, whereas a contracting firm, which has many other works to carry out, should always be able to do so. I know from experience that it is impossible to carry out electrical work satisfactorily unless the same workmen can be constantly employed, as new men will do a lot of bad work before they are found to be bad workmen. I have found the present methods of carrying out original works perfectly satisfactory, and it is in fact the method which it is proposed may be adopted in the future for buildings and roads.

(4). I am equally certain that the maintenance of electrical works will never be able to be entrusted satisfactorily to private agency. In the first place the maintenance of electrical works consists chiefly of what is known in building maintenance as "special repairs," that is to say, they are not periodical repairs but repairs which require to be carried out *at once*, directly breakdowns occur, and I can conceive no method by which an electrical officer can be responsible for such repairs being carried out immediately and satisfactorily, unless the work is entirely in his own hands: as these remarks apply chiefly to the maintenance of fans during the hot weather, it will no doubt be seen that this must be so. The periodical or ordinary maintenance work which is required can be carried out during the cold weather by the same staff who are responsible for the immediate repairs usually required in the hot weather.

(5). As regards the economy of such departmental maintenance, I have had tenders from private firms wishing to undertake this work in Lahore, which amounted to more than the whole of the yearly expenses of my whole office, including my maintenance staff, and which were very nearly double the cost of labour, materials and supervision used on such maintenance by my office in 1915-16. The amount of maintenance at present carried out in Lahore only is comparatively small (the capital cost of the works to be maintained in Lahore only being about Rs. 4,00,000), but this will be no doubt largely increased both in Lahore and other parts of the Punjab in the near future, and the extra cost involved to government in having such work carried out by private enterprise would in time become considerable. Maintenance work is of a nature which can steadily employ a constant staff of trained men, and the remarks as regards labour, on original works, do not therefore apply. I should be very strongly opposed to electrical maintenance being carried out by any other agency than departmental.

4,464. (III.) Changes in organization.—I have nothing to say regarding point No. (iii) to be taken up by the Committee except that under present conditions no reorganization of the staff of the Electrical Branch appears necessary.

4,465. (IV.) Relations with other departments and sub-branches.—The Electrical Engineer in this, and I believe in most if not all other provinces, is attached to the Buildings and Roads Branch of the Public Works Department. This no doubt is necessary for administrative reasons. It has the effect, however, of making it appear that the Electrical Engineer is a servant of that branch, and the consequence is that the Irrigation Branch of the Public Works Department, the Agricultural Department and any other departments which have executive work may and do carry out electrical work by means of their own officers, without reference to the Electrical Engineer. While I was officiating as Electrical Adviser to the Government of India (who is attached to the Public Works Department, Government of India) an electrical scheme of considerable magnitude for a department of the Government of India under Commerce and Industry was actually placed in the hands of a private consulting engineer by that department without any reference at all being made to the Public Works Department or the Electrical Adviser. Electrical work in buildings only may be quite a minor part of the work to be carried out in a province, and it certainly appears that the present conditions tend to make each department wish as is natural to have their own electrical officer, who would be under their own orders and control, rather than use an officer who apparently is the servant of another department, and over whom they have no control. I can make no suggestions for a remedy, but give the facts as they undoubtedly exist, and would point out that the present conditions do not make the most efficient use of electrical officers.

4,466. (V.) Decentralization and (VI.) Simplification of procedure.—The Public Works Code was drawn up and has been developed into its present form for controlling a certain well defined cadre carrying out the construction of what are almost entirely buildings, roads and canals. It will be obvious therefore that the Code will, in many respects, be found unsuitable for electrical officers, who are outside the regular cadre and for electrical works. There are, for instance, various references which have to be made to Superintending Engineers. As electrical officers as a rule work directly under the Chief Engineer, the Superintending Engineer is naturally entirely ignorant of all questions connected with their work: these references are nevertheless insisted on by the Accounts Department, because they are in the Code. The various tender forms and bill forms laid down for use in the Code appear to be quite unsuitable and unnecessary for a system in which original works are carried out by contract. Measurement books appear to be also unnecessary. The contractor's bill contains all information necessary and a simple system of ledger account appears to be all that is required for this system. In practice the keeping of

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a measurement book, under the existing conditions, consists of simply copying the contractor's bill therein.

(2). The Code as it exists at present appears in many ways to have been drawn up on the assumption that those for whose use it is intended would be either incompetent or dishonest. To me it appears ludicrous that I may not, on my own authority, spend Rs. 5 on furniture, or increase the pay of a temporary clerk by Rs. 2. The Code is a bar to any talent which any officer may show which might enable him to carry out his work more quickly and efficiently. No Code can possibly be made to govern every case which may arise, and it appears to me that its revision should give to every officer over a certain rank more powers to act on his own discretion than he possesses at present; his actions, with reasons, to be reported by him to the higher authority.

(3). The provisions of paragraphs 605 and 606, governing stationery, are unworkable in practice. Under these an officer may not order more or less stationery than for a year, without having any idea what work he will be called on to carry out for that year: he may also only send indents once a year. It is easy to foresee requirements of small articles, but it is quite impossible to foresee requirements of tracing cloth and drawing materials. If it was attempted to comply with the provisions of these paragraphs work in many offices would come to a standstill; this however would possibly be thought a small matter, provided that the Code was complied with.

(4). A great deal of an executive officer's time is now taken up in signing accounts papers on which his signature is only a matter of form, and it is therefore only a waste of his time to call for it. It appears to me that it should only be necessary for an executive officer, in passing a pay order, to see that the account to which the payment is to be allocated is correctly written on it, and that he should be no further concerned with it when payment has been made. At present he has to sign in full a works abstract containing figures which are to be entered in the register of works, and to initial himself every entry in the register of works, and to date his initials; that is to say, he is supposed to make himself personally responsible for seeing that payments have been allocated in accordance with instructions he has already given. I do not suppose that clerical work is checked to this extent, in any business in India or anywhere in the world, by an officer holding a responsible position. There is no doubt that, in practice, such checking is not done, and such signing, as stated above, is only a matter of form. Any checking that might be easily done is made harder by the fact that the papers to be signed contain figures only, and no details of what the figures represent. Considering that the accounts are all checked in due course by the Accountant-General's office, and all vouchers examined, the checking of such clerical work by an executive officer appears to be practically needless, and even should mistakes be made which remained undetected by the Accountant-General's office, the most serious result would be a wrong allocation of a payment. A wrong entry involving monetary loss would of course be very serious but here no such result is involved. Any wrong entry involving any considerable sum of money would always be automatically discovered when the accounts for the work in question were closed, as there would be a saving or excess to that extent on that particular estimate.

4,467. (VII.) Education, and (VIII.) Practical training.—In dealing with points (vii) and (viii) to be taken up by the Committee I would say that a large number of ex-students from government engineering colleges have passed through my hands at different times. In all of these I have found the same defect, namely, that their knowledge was entirely theoretical, and this being so, they are entirely useless for the purpose of practical every-day engineering work, both for government and for private engineering firms. Further, I have found that the standard of theoretical knowledge they possessed was not high enough to make them of any value for work which might happen to require theoretical knowledge only, without a considerable further training.

(2). I have also found particularly wanting any commercial ideas in such men; that is to say, though they might be trusted, after some practical experience, to carry out work theoretically correctly, it would not be carried out cheaply or expeditiously. Such training as they have received never, it appears to me, touches on the commercial side of engineering at all, whereas actually the utmost stress ought to be laid on the relations of money and any sort of engineering work. No engineer who does not realize that the use of almost all engineering is to make or save money will ever be of much use to any one.

(3). The problem of how to give a student the necessary practical and commercial training is a very hard one, and has not yet been solved by engineering colleges in Europe, in whose students I have found exactly the same deficiencies as those stated above. In the best electrical engineering colleges it is now the practice to sandwich a year or two in electrical engineering works between the beginning and the end of the theoretical training given, arrangements being made for this purpose with various electrical manufacturers. In India there are no electrical manufacturing shops, though there are now a few good electrical repair shops. There are however a fair number of first-class general engineering shops, and I have no doubt that some of these would be willing to take a certain number of engineering students as apprentices for a year or two during their college career. As these workshops are worked on commercial lines and organized to turn work out as cheaply as possible, such a training would tend to give students commercial ideas at the same time as practical training. On the North Western Railway at Lahore electrical apprentices are sent in to the locomotive shops for three years before they commence their electrical training.

(4). It should be impressed on electrical students that an engineer with electrical knowledge only is of very little use to any one, and that it is only when this knowledge is combined with a general all round engineering knowledge that he becomes valuable. It should also be impressed on students at engineering colleges that they do not become fully trained engineers directly, or for a long time after their college career is ended, and that their college training only gives them the rudiments of their profession.

4,468. *Conclusion.*—In closing this memorandum I would wish to say a few words regarding the position of government Electrical Engineers generally. Under the present conditions the Electrical Engineer under government is almost the only government officer with no assured position and no prospects; he is not pensionable nor has he ordinarily any provident fund (except the General Provident Fund which is of very little value) to subscribe to. Officers in certain provinces (six in all) have been given a special provident fund after serving some years, but this is entirely at the option of the local Government, and there are at present seven senior officers with neither pension nor provident fund, besides many juniors.

(2). It is an open secret among the commercial electrical community in India, that government are not securing the services of the best men, nor under the present conditions can they be expected to do so; a capable electrical engineer has better prospects in taking up a commercial career than by taking up a government position.

(3). Electrical Engineers have been lately selected and sent out by the Secretary of State on a 3 years' agreement. I consider that a preliminary 3 years' agreement is certainly necessary for such officers, whether recruited in India or England. At the close of these 3 years, however, such officers, if not found suitable, should be dismissed, but if found suitable and retained for further service, they should enter at once on fixed conditions of service which should not be less favourable than that of other officers of equal rank, standing and age in any other branch of the Public Works Department. These conditions should be fixed by the Government of India, and should be the standard all over India so that every officer, before entering on his 3 years' probation, would know precisely what his conditions of service would be if

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retained at the close of these, instead of these conditions lying entirely with the head of any particular local Administration, as at present.

(4). In fixing these conditions of service it should be borne in mind that most electrical officers are not merely executive officers; they are usually technical advisers to their local Governments on all electrical matters; they should initiate electrical schemes and work out the details of these technically and commercially, besides carrying out their construction when called on to do so. In addition to their above duties most electrical officers carry out at the same time the functions of an Electric Inspector under the Electricity Act. The maximum salary of an electrical officer should not, therefore, be fixed on the same basis as an officer in the Public Works Department who is an executive officer only.

(5). Electrical officers, seeing that they must be men of experience, will usually be, when selected, considerably older than men recruited for the general branches of the Public Works Department, and will usually be too old to be able to put in a full service for pension. They should, therefore, be given a special provident fund, similar to that given on state railways, and this provident fund should take effect from the commencement of service, if the officer is retained after his 3 years' probation.

(6). It appears to me also that an electrical officer, especially if an Englishman, recruited in India, should have special furlough rules. The present rules were designed for the majority of government servants, who come to India young, to learn their work, and they inflict considerable hardships on men of maturer age, who have already been in India several years at the time of their appointment.

(7). I consider that, to make the best use of such a small service as is the present Electrical Branch, the posting of officers, either temporarily or permanently, should be under the control of the Government of India. Most officers have a clause in their agreements with the Secretary of State to the effect that they are liable to serve in any part of India. This clause is at present a dead letter, because when once an officer is posted to a

province he cannot be transferred. Very few provinces require two first-class officers permanently at present, and consequently when an officer goes on leave a subordinate is put in to take his place, with very often disastrous results. It will also often happen that an officer cannot rise beyond a certain pay in a minor province, whereas he could fill a post of a senior officer in a major province. These are only instances, but it may be seen that any rearrangements of *personnel*, temporary or permanent, to get the best results from a very small staff must be done by the Government of India, exactly as is done at present in the case of Chief Engineers and occasionally I believe Superintending Engineers.

(8). The Electrical Branch in government service is a comparatively young one, so young that no electrical officer has yet retired under the age (or any) rule. It has not had to be considered, therefore, how such officers should be replaced. Most electrical Assistants at present are in a position of subordinates, and some may be qualified to take the positions of first-class electrical officers later on, while some certainly will not. I would suggest that electrical Assistants should in all cases be selected with a view to their being able to qualify themselves for the higher appointments, so that when the present officers retire there may be men available to replace them who have a knowledge of the work and the country. In dealing with this question it appears to me that it would be always more satisfactory to recruit officers for the senior posts of the Electrical Branch in India, rather than in Europe, seeing that no officer new to the country, put down in a province where he has no other electrical officer to consult or refer to, will be in a position to carry out his work efficiently for two or three years, because he does not know the country or the methods of doing things in India. During this time he may make many disastrous mistakes and waste a great deal of government money, and this has certainly taken place in the past, for the reasons given. Officers recruited for the General Branch are never placed in a position of responsibility until they have had considerable experience of the country and they have at all times senior officers to refer to for help and advice.

MR. C. C. T. EASTGATE called and examined.

4,469. (President.) The witness stated that he was the Electrical Engineer and Electric Inspector to the Government of the Punjab and that he had had two years' government service. He had been specially trained in England in electrical engineering for a period of 5 years; two years in a college and three years on electrical engineering works and he had since then been employed on electrical works in India. Though he had been for a number of years before his appointment to government in service with a private firm in India, he had been recruited in England.

4,470. His staff consisted of an Anglo-Indian assistant on a salary of about Rs. 300 a month and about 15 or 20 workmen who were employed on the maintenance of the installations in government buildings.

4,471. He was in executive charge of all the government installations in the Punjab, but as the Punjab Government had no power stations he had none in his charge. The electrical installations comprised electric fans and lights in buildings, a certain number of electric pumps, electric lifts, small electric apparatus for heating, cooking, etc., and a small generating plant in the Agricultural College at Lyallpur, and on the whole did not involve a large amount of work. All the government electrical installations enumerated by him obtained their power from public supply authorities, but he had not had experience of a serious dispute between a supply authority and government; nor had he experienced any practical difficulty in this connection in view of the fact that he was in direct charge of the government installations which obtained power from supply authorities and that he also possessed statutory functions under the Indian Electricity Act.

4,472. He had certain advisory duties to perform in addition to his executive and statutory functions as

he advised government in regard to such electrical schemes as were under investigation, and in such questions as arose between government and supply authorities. This portion of his work had, however, hitherto been comparatively unimportant and had consisted chiefly in advising municipalities, as government schemes were generally small. When a municipality wished to start a supply scheme, the municipal committee wrote to the local Government and requested the advice of the Electrical Inspector. That officer then designed a rough preliminary project and in doing so took into consideration technical details with a view to ascertaining whether the scheme was likely to be beneficial or not and its cost.

4,473. Except for one small scheme which had been referred to him, he had not been employed on the investigation or designing of hydro-electric works in the Punjab.

4,474. As his advisory work occurred only occasionally, in that he might be occupied on one scheme for weeks together and then possibly not have another scheme perhaps for several months, his time was divided between his executive duties and statutory functions. The statutory portion which concerned work under the Indian Electricity Act occupied at present about a third of his time, the remainder being absorbed generally by his executive functions.

4,475. He had had over 14 years' experience of electrical work of which about 11 had been spent with private electrical firms. During the two years he had been with government there had always been a certain amount of construction work in progress. Hence he concluded it was more advantageous, since it was more economical, to give out the construction of electrical works to electrical firms, than to carry them out departmentally. As work had hitherto been carried out satisfactorily

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for government, it had not been his experience, as had been contended in evidence in other provinces, that the construction of work by private firms was unsatisfactory because such firms usually placed in charge of a work an engineer who was not sufficiently qualified for the post. As there were two or three branches of Calcutta and Bombay firms in Lahore, he further did not agree with the contention that it was only possible to get first-class electrical work carried out by private enterprise in large presidency towns and not in places that were far distant from such towns, because firms might not depute to such places really reliable engineers. He admitted that as there was usually a large amount of work in progress in large towns it might be possible that construction work by private firms was more expensive in such towns, but added that he only had large works to carry out occasionally and that it was certainly not more economical to carry out the amount of work he usually had departmentally in the Punjab.

4,476. He advocated the carrying out of electrical maintenance work by departmental labour as he had invited tenders from firms in the Punjab for such work and had found that their charges were just about double what it had cost him to carry out the work departmentally. Such high charges on the part of private firms were probably due to the fact that they had not had experience of maintaining, say, several thousand fans, and accordingly that their figures had been based chiefly on guess work. As far as he was aware, no firm in India had ever been in charge of a large number of fans and lights. This drawback might be removed by experience but it would always be less economical to employ private enterprise on electrical maintenance work.

4,477. He employed only about five or six wiremen for government maintenance work and possessed no staff in connection with his duties under the Indian Electricity Act. Though he had seen a certain amount of bad wiring work done by private firms he had also seen work that had been well executed by private enterprise. The Act, however, did not make it compulsory for him to inspect the wiring work done by private firms. These firms had to work to a certain rule under the Act which insisted on wiring work being in good order both electrically and mechanically, and he had found before he joined government service that Indian wiremen were quite competent after they received sufficient training. He was however certain that there was a great deal of bad wiring work being done in large towns, like Calcutta and Bombay, where there were a large number of Indian contractors competing with one another, and agreed with the suggestion that a system of licensing wiremen might be introduced as he considered such a system would raise the standard of electrical work and be advantageous in other ways. There should be no difficulty in working the system, but the details of the scheme would require a great deal of careful consideration. The whole question had as a matter of fact been thoroughly discussed at the last electrical conference and though all the Electric Inspectors who were present did not agree on certain points, a number of suggestions as to how such a system might be introduced and worked had been submitted to government.

4,478. All his electrical stores were purchased in India, and as he had never indented on the Secretary of State for stores, this arrangement was satisfactory. He had not made a comparison of the prices at which electrical stores could be obtained from England and in India, respectively, and hence could not state whether the local stores were more economical. The purchases generally effected were inconsiderable and did not amount to more than Rs. 10,000 a year.

4,479. There was a small laboratory in the Punjab. It was maintained chiefly for work under the Indian Electricity Act, e.g., testing meters in cases of dispute, instruments, etc. He did not test the stores that he purchased locally.

4,480. He had had a certain amount of experience of the products of Indian engineering colleges when he was in private service but he had little knowledge regarding the electrical engineering education that students

received in such colleges. He agreed however with the suggestion that every electrical engineer should be a trained mechanical engineer. The question whether an electrical engineer should receive a training in mechanical engineering before or after the course in electrical engineering would not be of much importance, as long as the mechanical training formed a course of training by itself. He suggested that a commercial course might be added to the curricula of the several engineering colleges in order that electrical and other engineering students might learn to realize the value of money. He considered that the importance of money should be impressed on students during their collegiate course and its bearing on engineering details, and added that a commercial training was the one requirement more than anything else that was lacking in the engineers turned out by engineering colleges at present.

4,481. The province of the Punjab was entirely self-contained as regards electrical work and he had no official relations with the Electrical Adviser to the Government of India. He was however at liberty to consult that officer semi-officially when he desired to do so. The local Government was empowered to invite the co-operation of the Electrical Adviser officially and had exercised this power on one occasion when he himself had officiated for the Electrical Adviser. At the time he officiated for the Electrical Adviser he also attended to his own duties as Electrical Engineer in the Punjab. Hence he had in effect consulted himself. The reason for such proceeding was that as Electrical Adviser he could consult the Solicitor to the Government of India on the case in question, while as a local Electric Inspector he had no power to do so.

4,482. The most suitable system for the recruitment of Electrical Engineers was to recruit such officers temporarily at first on three years' agreements and to follow this up by making them permanent. He was personally not in favour of permanent employment for anyone, but since it was the system under which all government servants were employed in India he considered that Electrical Engineers also should be employed permanently. Besides it was unfair that such officers should constitute an exception to the general rule in this respect. If government service generally were made a temporary service he would similarly then suggest that all Electrical Engineers might be recruited on a temporary basis.

4,483. He did not disapprove of a pensionary system for engineers, but mentioned that it was entirely on account of the late age at which Electrical Engineers were usually recruited that he had expressed himself in favour of a provident fund rather than a pensionary system for such officers. In view of this fact too, the salary which Electrical Engineers should receive in the first year of their appointment should be approximately the same as that which Public Works Department engineers of the same age received. He added that an Electrical Engineer recruited at the age of 28 or 30 might be assumed to have had the same amount of experience as a man of similar age had had in permanent Public Works Department service, and it was desirable for the benefit of the service in India as a whole that Electrical Engineers might be placed on the same rates of salary and status as Public Works Department engineers.

4,484. In respect to the method of recruitment of Electrical Engineers, he suggested that an attempt should first be made to obtain suitable men in India and that application should be made to the Secretary of State only if men could not so be obtained.

4,485. (Mr. Cobb.) The Electrical Engineer's accounts were maintained generally according to the system followed by the Public Works Department, and he was convinced that the accounts rules might with advantage be simplified. He had not submitted to the Public Works Department the suggestion he had made in his written evidence for effecting simplification in the present accounts procedure, but he considered the present system was a great drawback to his work as an executive officer as it absorbed a considerable portion of his time. He added that if he dealt with his accounts work as it was

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supposed to be performed, it would take up half of his time.

4,486. Before he entered government service he was employed as the engineer to a firm of contractors, in fact as a contractor himself. At that time he came across a number of very creditable rivals in private enterprise.

4,487. (Rai Bahadur Ganga Ram.) The Amritsar Power Station had been inspected by him in order to see that it conformed with the rules under the Indian Electricity Act, i.e., that the height of the wires, etc., was correct, but he was not concerned with the manner in which it was worked or with its maintenance.

4,488. Government charged municipalities certain fees for the advice they received from the Electric Inspector. These fees were fixed on a sliding scale which varied according to the size of the scheme involved. He did not receive any portion of such fees as his advice to municipalities constituted part of his duties.

4,489. If a separate Electric Inspector were engaged to undertake only the statutory portion of his work, he agreed that an individual not so well trained all round as himself might be appointed to the post, but did not think that a salary of Rs. 400 per mensem which was at present paid to a boiler inspector would suffice. The duties under the Act did not require very great training for their performance and in the majority of cases they related to the settlement of cases connected with disputes concerning meters. Nevertheless the rules under the Electricity Act called for a certain training before an officer could be appointed as an Electric Inspector.

4,490. Although he made it a practice to throw the construction of electrical works open to competition

by inviting tenders, he requested only such firms of whose work he had had experience to submit tenders.

4,491. His own training had embraced mechanical engineering and he was competent to place in position boilers, etc.

4,492. (Sir Noel Kershaw.) A cadre of Electrical Engineers should be constituted in India consisting of men on various rates of salary so that when a senior appointment fell vacant the next senior officer could be promoted to fill it. He admitted that local Governments would probably disapprove of such a scheme but thought that, from the point of view of the good of India, local Governments should accept the suggestion. One province would not require a more highly trained Electrical Engineer than another would, since electrical installations in the minor provinces had to be constructed just as well as those in the major provinces; nor did he think the fact that one province had power stations while another had no such stations made any difference, since in the whole of India there were no power stations larger than about 50 or 60 horse power which were ordinarily installed by and under the control of the local Government.

4,493. He admitted in connection with the contention in his written statement that a capable Electrical Engineer had better prospects in taking up a commercial career than by taking up a government position that the prestige attached to government service might influence a man's decision considerably as to whether he should or should not enter government service. He did not agree however that the Government of India had on the whole secured for their appointments of Electrical Engineer the class of men that they should have recruited.

At Lahore, Tuesday, 10th April 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., I.C.S. (President.)

SIR NOEL KERSHAW, K.C.B.

C. S. COBB, Esq., M.V.O.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

D. W. ATKMAN, Esq., C.I.E., Chief Engineer and Secretary to the Government of the Punjab, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary.)

The Hon'ble Mr. H. J. MAYNARD, C.S.I., I.C.S., Financial Commissioner to the Government of the Punjab.

Written Statement.

4,491. There is a page in the Civil List which shows the Public Works Department circles, divisions and sub-divisions with the civil districts to which they correspond. There is one Executive Engineer of the Roads and Buildings Branch for the four civil districts of Rawalpindi, Attock, Jhelum and Gujrat, some 12,000 square miles; one for Shahpur, Jhang, and Mianwali, nearly as large and including the whole of one new Canal Colony and a substantial fraction of another; one for Lyallpur, Sialkot and Gujranwala, including nearly all of the great Lower Chenab Canal system, all of the Upper Chenab Canal, and a thickly populated and advanced submontane district; one for the four rich and highly developed Sikh districts of Jullundur, Hoshiarpur, Ferozapore and Ludhiana; and so on. The ordinary district officer who does not happen to be in a district in which a Public Works Department divisional headquarters is situated rarely sees the face of an Executive Engineer, whose local charge is obviously too large for effective personal supervision even of the most general character, pace the official memorandum which declares that "in him is vested the management of all public works within his division.

He arranges the details of their construction, superintends the account in connection with them, and is responsible for their proper custody and efficient repair..... He prepares designs and estimates..... It is his duty to pay strict attention to the economical application of all labour and materials and he is responsible for the good quality of all work done under his orders." He cannot do all these things, except as a desk official, exercising control from an office and subject to the limitations which this position involves.

4,495. The works to be supervised are often scattered over very large areas. When I was Commissioner of Multan, it was proposed to repair the Border Military Police posts of a very long stretch of frontier in Dera Ghazi Khan. The Public Works Department had to depute an officer who rode 800 miles and prepared his report with estimates, after three months of continuous work and travelling. But this was child's play compared with the supervision of these scattered small works when they came to be carried out. I believe it was arranged that the local Balooch chiefs should do the supervision. Any other system would have been unbelievably expensive; yet this is only an extreme case of a difficulty

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which is for ever recurring in one degree or another. When the Executive Engineer of Shahpur (who was also Executive Engineer of Mianwali and Jhang) was engaged on the specially important and difficult work of the Nammal dam in Mianwali, the other part of his charge saw nothing of him for months together.

4,496. Even sub-divisional officers often have charge of two civil districts, and in one instance of three (Hoshiarpur, Ferozepore and Ludhiana). Their local charges correspond more nearly to the proper size of an executive charge, but they are sometimes of subordinate rank and when of higher rank they are of shorter experience, and they have not the authority of the executive unit of the Department.

4,497. The difficulties of effective field supervision lead to reliance upon certificates and countersignatures and all the deceptive machinery of a paper control. The nature of their work deprives the Roads and Buildings Branch of that most effective practical test, of return upon capital outlay, which checks waste and extravagance on canals or railways. When one can neither see thoroughly all that is done, nor test it by the calculation of interest upon expenditure, false criterions make their appearance.

4,498. If a history of the Public Works Department should be written a characteristic feature would be the gradual differentiation of functions within it. At the beginning we should find a body of officers turning their hands to every engineering duty which presented itself, military or civil, roads, buildings, canals or railways. Then would come the separation of military from civil (not everywhere complete, I understand, even now) and the development of separate or virtually separate branches for canals, railways, roads and buildings respectively. The Roads and Buildings Branch retains all the residuary functions, and is expected to deal with everything which is not covered up by military works, by irrigation, or by railways. Here, undoubtedly, is its principal handicap. New demands create new types of works, but the new demands and the new types of work are in existence long before the entertainment of experts specially qualified to deal with them can be justified by the extent of the need for them. Gradually, indeed, then experts appear. Archaeology is recognised as a special section; drainage and water-works become common enough to justify a Sanitary Engineer and his Assistants; increased use of machinery creates a staff of boiler inspectors; and an Electrical Engineer and an Architect make their appearance. But the provision of experts, in a growing and changing social economy, is always and inevitably behind the need for them. Chemical laboratories are needed for educational or research purposes; the roads and buildings engineer must learn to make them. Elevators are to be built; the same officer must pick up information from Canada or elsewhere and turn his hand to these. Then there is an important road bridge to replace a ferry; and the roads and buildings engineer must learn to be a bridge builder. Presently some advanced metropolis feels the need of water-borne sewage arrangements and a hot and cold water supply; and the Roads and Buildings Branch, with such help as a Sanitary Engineer accustomed to surface drainage and the simplest of water-supplies can render, must grapple with these requirements also.

4,499. The old method, and the natural one in a department expected to take upon itself all the residual engineering functions, not appropriated by military works, railways and canals, was to assume every officer to be an expert in every line. The Executive Engineer always prepared the design and estimate whatever the subject matter, and whatever his qualifications as an individual; the Superintending Engineer always scrutinised and passed or amended it, the Chief Engineer acting as the final sanctioning authority. With the slow development of specialist agencies a change begins to appear. The Sanitary Engineer, for instance, often prepares a design himself or employs his Assistant to do so, although he is of superintending status, instead of calling upon the local Executive Engineer. The Electrical Engineer and the Architect do the same. That is to say a group

of headquarters specialists begins to take upon itself executive functions, each in his own line, and the old system by which every kind of work was passed in review by each member of an engineering hierarchy in an ascending series, without regard to the senior's fitness, by special study or special knowledge, to check the work of his junior, begins to give way. In the survival of that system (a survival inevitable but in a perpetually diminishing sphere) we have an explanation of certain failures and also a reason for a certain costliness in machinery. In place of a body of experts each dealing with the work of his own line, we have a multiplication of check and control by the members of an official hierarchy having general but not expert knowledge. Work is done twice or thrice over; but never by the man best qualified to deal with it, and the second and the third doing of it have the tendency which all such mere check proceedings show, of degenerating into mere routine. This weakness, as I have endeavoured to show, tends to work itself out of the Department, as the growing demand for experts in particular lines justifies the entertainment of them. The tendency requires acceleration, until the Roads and Buildings Branch shall have developed into a body of specialist engineers, dealing each with his own subject throughout the provincial area; supplemented by some less expert agency or agencies, in training for advancement to specialist status or engaged in dealing with those simpler works for which specialist knowledge, in the highest sense, is not required.

4,500. What the functions of these separate specialists would be, it is not possible to foresee in detail. There will be gradual advance, gradual further differentiation. But it is easy to imagine the need of a specialist in large road bridge construction, and of one in water-borne sewage disposal. And one of the experts, I think, will be a rate and contract expert who will scrutinise estimates and bring a wide provincial experience to bear upon the proposed rates, and bring in contractors from elsewhere, even from outside the province, when there are indications of overcharge. A profit making department such as a railway has its rate expert for freight charges; and a spending department such as the Public Works Department is not less in need of such an authority to help it to decide on what scale it should pay, and how subsidiary agencies can best be brought into existence to carry out its work.

4,501. In an attached tabular statement (Annexure A) I have stated and examined certain specific complaints against the Roads and Buildings Branch. Every department of course has its failures, but buildings and roads are there for all to criticise. The majority of the defects, in so far as they are substantiated, are attributable either to the large size of the executive charges making real supervision (as apart from paper checks) impracticable; or to the demands upon a non-specialist body for specialist work. There is also, in my opinion, a tendency, natural to every large spending department, to do things too well, and despise those methods which are cheap and "good enough for the purpose." This tendency may be partly due to routine methods, and the easiness of applying standard specifications, rather than thinking out cheap makeshifts; partly to the lack of any strong motive for economy such as a local body often has in the narrowness of its pecuniary resources.

4,502. While the roads and buildings executive charge is unwieldy in size, and impossible of effective field supervision in consequence, there is some overlapping of engineering functions within it. I say nothing, in this connection, of overlapping between the Irrigation and Roads and Buildings Branches. In the Punjab at all events, the irrigation engineers (already burdened with extraneous revenue functions) have plenty of their own work to do. But there are also the engineering agencies of the local bodies, covering the same grounds as the officers of the Roads and Buildings Branch and doing work closely similar to the more humble and simple portion of the work done by the latter. Time, skill, and travelling allowances are largely wasted in consequence of this duplication.

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[Continued.]

4,503. A tabular statement prepared for government in 1910 showed an outlay on district (rural) board engineering establishments of Rs. 1,87,050 per annum, or Rs. 2,13,396 including contingencies; and an outlay on municipal board engineering establishments of Rs. 1,26,010. The average outlay on works for three years ending 31st March 1911 was Rs. 13,58,132 (district board) and Rs. 12,74,768 (municipal), giving a percentage of establishment charges of 15·7 for the former and 9·8 for the latter. As many municipal works are carried out by Public Works Department agency, the latter percentage is misleading unless Public Works Department charges for establishment are added, which apparently was not done.

4,504. At that time there were 21 district engineers with salaries costing Rs. 91,518 per annum, and 11 municipal engineers with salaries costing Rs. 70,752. These figures for municipal engineers give a somewhat misleading impression. Three of the engineers referred to were employed at Simla, one for buildings and roads, one for the water-works, and one for the pumping station. Four officers were employed in Lahore, two of them on the water-works. One of the so-called engineers is actually a Secretary (at Ferozepore). The almost universal rule is that municipalities do not employ engineers. They employ overseers or sub-overseers in some cases, and they often make a contribution to the cost of the district engineer and share his services. When municipal engineers are entertained, they are usually for special purposes such as the management of water-works.

4,505. The pay of the district engineers varies very greatly and sometimes unaccountably. The pay is sometimes as low as Rs. 100 or Rs. 150. In one case (the rich district board of Lyallpur) it is as high as Rs. 650. The comparatively poor district of Jhelum pays Rs. 300, when Ferozepore pays only Rs. 150. Gurgaon and Amritsar each pay Rs. 500. Jullundur pays Rs. 330. Ambala and Dera Ghazi Khan each pay Rs. 260.

4,506. The appointment of district engineers is made on no system at all. A Deputy Commissioner with a turn for works will probably try to induce his district board to offer good pay, and if the district board has the necessary funds, and the vacancy occurs in the time of the officer who interests himself specially in such matters, a good district engineer may be secured. I have known six good (that is, thoroughly honest and energetic) district engineers, of whom one was extremely good, probably as good as an Executive Engineer of the Public Works Department. I have known a large number of bad ones; drunken men, dishonest men, incompetent men, men who had served till their pension from the Public Works Department was due and were too tired to do much thereafter. I asked an officer, well known for the interest which he takes in district works, to recount to me his experiences of district engineers. He was in the same district for six years. When he first arrived the district engineer (by an obvious job) was the brother of the head clerk, and quite incompetent. He then got a retired sergeant of the Military Works Department, who took to drink. Having disposed of the drunkard, he secured the services of a keen and capable youth who worked well for two years and then got a better post elsewhere. The next district engineer was of the same type. Though the pay was Rs. 300—50—500, the incumbent got a good railway appointment and left. The fifth man had many letters after his name, but was a drunkard and was bad at practical work. This completed my informant's term in his district. He left to his successor to get rid of the fifth of his experiments. My informant went on to another district, where he found a young district engineer, in bad health, drawing Rs. 250—10—300, plus Rs. 50 municipal allowance; and never likely to be useful.

4,507. The present system by which district boards pick up men for themselves is not a sound one. They have neither the knowledge nor the opportunities of making good selections, except by a fortunate accident. The local Public Works officer is often a member of the district board, and might advise them. But he has more

districts than one in his charge, and is too busy and too peripatetic to help, and perhaps does not ordinarily realize any particular responsibility for doing so. There is another difficulty, that the boards' means are often very small. Government made a lump grant of 1½ lakhs per annum in 1906 for engineering establishment which has since been merged into grants for general purposes, but this does not go very far among 29 districts. A further difficulty arises from the fact that there is no means of changing a district engineer except by dismissal. It is often an administrative advantage to be able to move a man elsewhere, where work is lighter or of a different character or friction less probable. But this remedy cannot be applied to district board engineers.

4,508. Many officers whether reasonably or unreasonably criticise the Public Works Department for high charges, and even (sometimes) for unsatisfactory work. But they all concur in saying that district board work, though generally cheaper, is far less satisfactory on the whole. I have seen a great deal of the Punjab as Commissioner of four out of its five divisions, and I have toured more or less comprehensively and in detail in most of its districts. My general impression is that the district board work, particularly that on roads, is not up to the general standard of the administration, and that the province is consequently weak in the matter of communications except on a few main routes. But I should find it hard to apportion the blame for district board failures between inadequate resources on the one hand and the bad district engineers on the other. In regard to one district I could definitely say that the money spent would have produced far better results if the district engineer had been more honest and more competent; and I have no doubt that a better class of district engineers would generally bring about a better state of local works.

4,509. It is a matter of great importance to improve the agencies which supervise the works of local bodies. More systematic selection, better pay and prospects, facilities for transfers from the service of one body to another, are the measures required. All bodies do not require men of the same status and capacity. Lyallpur, Lahore, and Amritsar need for their present district board work alone an engineer of the calibre of an Executive Engineer of the Public Works Department. Most other districts could do quite well with an officer of the type of Assistant Engineer; some perhaps with an upper subordinate, if work now falling upon the district board be alone considered.

4,510. The inference to be drawn from the above facts is not an inference adverse to local self-government. The district board, as it actually exists in the Punjab, is the Deputy Commissioner, supplied with certain machinery and certain funds, and set among his *zaildars* and local notables who give him all the information which he can digest, and as much advice (often good in quality and sufficient in quantity) as he is willing to receive. Some officers make a great deal of valuable use of their district boards both as advisers and as a local executive and supervising agency; but they all have an absolutely complete control of the executive machinery and of all financial resources not definitely earmarked for some specific departmental purpose; and when things go wrong (otherwise than by reason of lack of funds or defects of organization such as a local officer cannot set right) the fault is theirs, not that of the so-called self-governing body. In arranging, on an improved plan, for the execution of local works, it would be a complete mistake to eliminate the actually valuable, and potentially yet more valuable machinery of the district board. What is needed is to increase its resources, to improve its professional staff and make more extensive use of it, while continuing to utilize the board's incomparable facilities for the supervision and cheap execution of petty works and repairs in out-of-the-way corners. The case of the Border Military posts (paragraph 4,495 of this memorandum) illustrates what I have in my mind. There are things which a department of government simply cannot do.

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4,511. The principal defect, from an engineering point of view, in the administration of municipal committees, is that they do not pay proper attention to the maintenance of important sanitary works, such as water-supplies and drainage systems, which have been constructed for them by the professional agency of the Public Works Department. This is because, generally speaking, they have no engineers, and the obligations of the district boards' staff, to the cost of which they contribute, are not perhaps definite enough; but it is also partly because steps to point out to them their duties in such matters as the creation of depreciation or renewal funds, systematic financial provision for the cost of repairs, arrangements for annual inspection of engines and boilers by engineering firms, are only now beginning to be taken; in a word, from administrative inexperience, natural enough in a province where large sanitary works are a novelty. In improving the district board engineering staff, it will be necessary to define its obligations towards the towns, and to insist upon their fulfilment in return for the allowances to be contributed from municipal resources.

4,512. When the experiment was tried in Bengal of making over the maintenance and repair of provincial works (and some imperial buildings also) to district boards, a subordinate Public Works Department staff was at the same time transferred to the boards, and the local Government announced its willingness to consider increased allowances to district engineers and to transfer additional clerks from the Executive Engineer's to the district board office (Government of Bengal, Public Works Department, Circular No. 49-E., dated 31st December 1891). When the system was reconsidered in 1897, the majority report of the committee appointed for the purpose laid stress on the inefficiency of certain district engineers. There was apparently no systematic attempt to improve the quality of this class of officers; and the inferences to be drawn from the apparently unsuccessful results of the experiment must be limited by this consideration. If we should at the present moment, in the Punjab, decide to make over any considerable part of the work done by the Public Works Department to local bodies and not make a substantial improvement in the engineering staffs of those bodies a preliminary to the transfer, there would beyond question be a grave sacrifice of efficiency. But if the change be made after provision for this essential preliminary, the Public Works Department, or the agencies which will partly replace it, will be harnessed to an effective and ubiquitous administrative machine, instead of functioning in the void, like a driving wheel to which the belt has not been adjusted.

4,513. Before I saw the memorandum of the local Government on matters referred to in Resolution, Government of India, Public Works Department, No. 06-E.A., dated 24th November 1916, I was endeavouring to work out a plan by which the services of the Public Works Department officers would be lent to local bodies. There would be no difficulty about inducing the local bodies to apply for the services of such officers, so long as the financial path was made smooth enough. But there would be difficulty, at all events at first, in inducing the officers to accept such services except by offering deputation allowances on "foreign" service, which would greatly increase expenditure; and it is hard to see how government could proceed if general unwillingness should be evident, as is quite possible till more prestige has begun to attach to the service of local bodies.

4,514. There seems no solution except the creation of a separate pensionable district board engineer service to be recruited partly in India and partly in Europe; the class corresponding to Assistant Engineers receiving Rs. 380—750, as recommended by the Public Services Commission, if recruited in Europe, and on Rs. 300—550, if recruited in India. Efficient and satisfactory district board engineers already employed should be admitted to the new service. The most important districts would have officers of status and pay corresponding to those of the present Executive Engineers. The Roads and Buildings Branch would be cut down by the general process of cessation of recruitment to a

body of specialists, together with a limited number of officers corresponding to the existing Superintending Engineers, who would inspect and report on work connected with roads and ordinary buildings, and act as advisers upon communications, some special metropolitan appointments and a Chief Engineer and his Secretariat. There should be a channel of promotion from the district board service to the Roads and Buildings Branch, but officers entering the former would understand from the outset that they would be required to serve under local bodies. The terms of the grants-in-aid to be made by government to the local bodies would ensure the entertainment of subordinate staffs of adequate strength and quality. All work not properly falling to one of the central staff of specialists would be done by the local body's engineering staff.

4,515. Under this system there would be an engineering executive unit in every civil district, but varying in rank and length of experience according to the importance of the district from an engineering point of view. There would be sub-divisions in some districts—there are two now under the district board engineer of Lyallpur. Sometimes the sub-divisions would be held by juniors in training for district charges, sometimes by subordinates. The system must provide for the necessary proportion of men in training for the district charges. The period of training for the charge of a less important district is a question for engineers. Probably two years would suffice.

4,516. District boards will lose their existing authority of appointing and dismissing district engineers, and they will be liable to have transfers made against their will. In practice this will only mean that Deputy Commissioners make these sacrifices. Also they will have to accept the charge of the salary of the engineer posted to them, or the commutation payment to be fixed for general participation in the scheme; but there will necessarily be certain grants-in-aid, to set off against this, for district boards generally speaking have no means of increasing their resources, and a substantial fraction of the work to be done is work for which government now entertains staff.

4,517. I do not feel competent to make a satisfactory calculation of the comparative cost of the existing system and that suggested; but I have endeavoured to make a rough one based upon the probable difference of the cost of the superior staff in the two cases. It is as follows, and it does not justify hopes of savings.

Existing members (not taking account of officers who are seconded for military duty.)	Probable members under the system suggested.
1 Chief Engineer . . .	1 Chief Engineer.
2 Secretariat officers . . .	2 Secretariat officers.
3 Superintending Engineers . .	2 Superintending Engineers.
1 Superintending Sanitary Engineer.	1 Superintending Sanitary Engineer.
15 Executive Engineers . . .	20 Executive Engineers (to provide for one in each of 15 districts, with a margin for leave and temporary promotions).
7 Assistant Engineers . . .	20 Officers of Assistant Engineer status including officers in training.
7 Temporary Engineers . . .	

Taking the mean pay of a Superintending Engineer at Rs. 1,800, that of an Executive Engineer at Rs. 1,000 (recruited in Europe) and Rs. 800 (recruited in India), say at Rs. 900 on the average, and that of Assistant Engineers at Rs. 580 recruited in Europe) and Rs. 450 (recruited in India) say, Rs. 515 average, this would involve an additional expenditure of Rs. 69,480 per annum. To this we have to add an uncertain sum for additional specialists which I would propose to calculate at Rs. 1,000 per mensem each for three officers, Rs. 36,000 per annum. Against this is to be set off Rs. 91,618 saved by the reduction of the district engineers.

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[Continued.]

This does not allow anything on account of pension charges, or anything for the additional subordinates who would probably be needed to fill sub-divisions of districts. The scheme is evidently not to be justified by any financial saving on establishments, but solely by the increased efficiency which it promises. At the same time, the calculation has allowed for some additional specialists who would probably be required anyhow in course of time. No claim can be made for a saving on municipal engineering staff, without a close investigation of the possibilities in each instance.

4,518. Turning now to the question of the execution of work by contractors, I note that the present system of the Roads and Buildings Department is to employ contractors for most works, but contractors on a very small scale, whose responsibility is limited to the completion of particular tasks under the immediate supervision of overseers and sub-overseers and subject to the control and occasional inspection of higher officers. The North Western Railway employs contractors on a much larger scale, and one hears of particular contractors completing whole branch lines of many miles in length. I understand, however, that these large railway contracts are really only contracts for earthwork and rail laying, so the fact that they are possible does not show that a greater delegation of functions to contractors is possible to the Roads and Buildings Department. The really important and expensive parts of railway construction, the bridges, the tunnels, the building of large stations, are not dealt with on the same system, so far as I am aware.

4,519. In my experience there have only been two cases of large contracts undertaken for public works. One was the case of the provision of underground sewage and special patent impermeable pavement, in a portion of the town of Amritsar. This was undertaken by a European firm of Lucknow and is stated by the Deputy Commissioner to have been most efficient and satisfactory. The other was the case (referred to in the tabular* statement attached to this memorandum) of the flood-gates at the Nammal dam. Though the firm in this latter case was one of high reputation the experience has not been an encouraging one. Certain other cases of which I have no knowledge are referred to in the memorandum of the local Government.

4,520. Apart from large contracts, it is theoretically possible to give a larger scope and a larger responsibility to contractors of medium status, e.g., when a bungalow is to be built, the daily supervision of the overseer might be given up, and the work, when completed, passed by an Inspector of Works, the contractor being intermediately responsible for all engineering and constructional details instead of being watched at every moment. Multitudes of houses are being built every day by private persons, and it is natural to ask how this work is supervised and why a similar method is not open to the Public Works Department. I gather from informants that the owner has to look to matters pretty closely if he wants good work; but the owner is not, generally speaking, an engineer, and the engineering knowledge has to be supplied from somewhere. The class of engineers in private practice is virtually non-existent in the Punjab

but the *raj mistri* (as no one can doubt who has noticed the lofty buildings common in our towns) somehow contrives to fill his place in a very effective fashion, presumably by the help of his hereditary craftsmanship and a building tradition. Someone supervised the building of the large factories and the high smoke stacks, which are becoming numerous in the Punjab.

4,521. Is it possible to improve the *raj mistri* by a modern engineering education, or by an industrial education less ambitious in scope, and not destroy his hereditary craft in the process? It is certainly worth trying, but the question raises all the problems of industrial and technical education on which experts are by no means agreed. We have in the Punjab a central committee which deals with these matters, but I gather from its proceedings that it has not definitely decided whether industrial education means manual training in particular crafts, or a general development of the mental powers so that intelligence may be brought to bear upon future manual work.

4,522. Under a system of *responsible contract*, the honesty of the work would be guaranteed by the contractor's reputation. He would have too much to lose by dishonesty, for his business would depend upon his record with the Department. I can see no ground for doubting the possibility of bringing into existence a class of contractors of the kind desiderated; but the Public Works Department might have to make concessions in the way of accepting overseers with a hereditary rather than a Roorkee qualification and liberal advances† would be essential. I have already suggested that the Department needs a rate and contract expert at its headquarters. It should be the duty of this officer to develop the possibilities of the contract system, so that the *responsible contractor* may serve the Department, as he already serves the private builder. The officer would be a useful member of the central committee for industrial and technical education, as he would virtually represent the employer in one important group of trades.

4,523. Under head (iv) of the questions formulated I have only to suggest that all plans for residential houses should always be passed by a mixed committee of the Public Works Department and civil officers. If standard plans of a satisfactory kind can be drawn up, it would be an excellent thing to make models of the resultant type of house, so that the plan may be better understood. The idiosyncrasies of an individual should never be allowed to determine the plan of his house; for we are all transient creatures, here today and gone tomorrow. As far as possible everything should be standardised and stocks kept; windows, doors, furniture, and fittings of all sorts.

4,524. The writer of this memorandum is a member of the Indian Civil Service employed in the Punjab since 1880. He was Judicial and General Secretary to Government from 1896-1899, Deputy Commissioner of Ambala 1899-1903, Commissioner in four out of the five divisions between 1906-1915. Financial Commissioner and President of the Sanitary Board at present.

† This would apparently be a perfectly sound policy. A firm which could afford to wait till a work was complete before receiving anything would be over-capitalised.

* Annexure A.

ANNEXURE A.

Statement of alleged defective and expensive works done by the Roads and Buildings Branch.

Work.	When completed.	Nature of alleged defects.	REMARKS.
A.—FAULTS OF DESIGN.			
1. Deputy Commissioner's house at Gufjanwala.	Within the last two years.	1. Arrangement of doors, windows, and verandah makes the house unbearably hot. 2. Drawing and dining room doors so narrow that two people could with difficulty pass abreast. Apparently these doors were intended for bed rooms and rice room. 3. White paint so bad that it required renewal after a year.	A civil officer passed the plans and the object in view was the maximum accommodation with the minimum rent. The Public Works Department says "the usual procedure was adopted of omitting verandah on the south side for economy." The case appears to me to illustrate the need of a different procedure in passing the plans of residential houses. (Sd.) H. J. MAYNARD.

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[Continued.]

ANNEXURE A.—contd.

Statement of alleged defective and expensive works done by the Roads and Buildings Branch.—contd.

Work.	When completed.	Nature of alleged defects.	REMARKS.
A.—FAULTS OF DESIGNS.—contd.			
2. Drainage system of town of Majliha	First completed about 1907. Owing to its unsatisfactory character the Sanitary Board agreed to contribute the whole cost of putting it right.	1. Faults in levels. 2. An uncemented drain was located along the edge of some <i>Lacha</i> houses, one or two of which fell down in consequence.	It has been ascertained that there were no faults in levels but that the spring level rose considerably after completion of the work. The problem of dealing with the drainage of Majliha which is on very low ground is very difficult. The second allegation is true. (Sd.) H. J. MAYNARD
3. Record-room at Shikot	....	The light provided in the lower part of the building is inadequate. Rs. 2,000 more have to be spent to remedy the defects.	Civil Officer must have passed the plans but is a bad judge of such things on paper. (Sd.) H. J. MAYNARD.
4. Record-room, Dharamsala	1909 or 1910	Joints of wooden racks run into <i>daffi</i> walls though site infested with white ants.	Civil Officer must have passed plan and ought to have detected this flaw. (Sd.) H. J. MAYNARD.
5. Head Clerk, District Office, bungalow, Jullundur.	1911	First built upon the plan for B Class Clerks' Cottage but found to cost more than a clerk could be required to pay in rent. It was therefore cut down in size. The rooms are now too small. One bed-room is 13' 10" x 11' 10". Sitting room and dining room each 13' 8" x 11' 7". Low roof and walls 18 inches thick. Excessively hot. The Head Clerk could not live in it and government has finally agreed to refund the rent paid by him.	The summary cutting down of this building by a high Civil authority seems responsible. The hands of the Public Works Department were forced in this matter. (Sd.) H. J. MAYNARD.
6. Assistant Commissioner's bungalow at Jullundur.	....	Faces due north and south and east and west has thin brick walls and a narrow verandah. A furnace in the hot weather, almost uninhabitable by a European.	Enforced economy doubtless accounts for the thin brick walls and the narrow verandah. (Sd.) H. J. MAYNARD.
7. Houses built at Dharamsala after the earthquake.	1909 or 1910	Norwegian pine wood was used for inside fittings and was put in during the monsoon. When dry the wood shrank very much with bad results to joints and general appearance.	There was probably a good deal of hurry over this work (Sd.) H. J. MAYNARD.
8. Rest-house at Kakar (Amritsar District).	....	Built upon <i>Kalar</i> (alkaline) soil without <i>Kalar</i> proof courses, consequently extensive repairs necessary very soon after building.	No information regarding this is available in the Public Works Department office. (Sd.) H. J. MAYNARD.
9. Cubicle barracks in Borrial Central Jail, Lahore.	....	1. Floors sank after the building was made owing to the earth not having been properly rammed. 2. Iron fittings for opening and closing cubicles tore themselves out of the masonry. Design not good and masonry work bad. 3. Lime pointing so badly done that repairs had to be begun within a few months. 4. Locking arrangements bad. A prisoner could open his cell in about three minutes. 5. The verandah roofs of new cubicles are being rebuilt owing to the bad quality of the work. 6. The water-supply is not yet finished though work on it began in December 1914.	The Public Works Department writes:—"The whole work was one of which the Department was not proud. The Executive Engineer was subsequently dismissed, and the contractor barred from further work." (Sd.) H. J. MAYNARD
10. Gates to the Nammal Irrigation dam.	About 1913	The gates cannot be completely closed and the canal flows perpetually whether the water is required or no, thus using up the supply in the lake, to no purpose.	The delay in the completion of the water-supply is due primarily to want of detail in the preliminary estimate which was not preceded by a trial boring and to subsequent inaction by an Executive Engineer who has retired. But there has also been difficulty owing to the war in obtaining plant from home and in getting satisfactory quotations in India. (Sd.) H. J. MAYNARD.
11. Mall's house in Jail garden at Gujranwala.	....	Is unsafe owing to cracked walls and has been vacated.	The designs and erection were carried out by a large European firm. That the defect in the design was not discovered at an earlier stage, appears to me due to the initial error of requiring the Roads and Buildings Branch to deal with what is essentially an Irrigation project. (Sd.) H. J. MAYNARD.
12. Lahore Central Jail, Jail Press.	The end wall fell out very soon after construction.	

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[Continued.]

ANNEXURE A.—concl'd.

Statement of alleged defective and expensive works done by the Roads and Buildings Branch.—concl'd.

Work.	When completed.	Nature of alleged defects.	REMARKS.
B.—EXPENSIVE WORKS.			
13. Elevator at Lyallpur	Not yet completed	A general allegation that it is going to cost more than any elevator in other countries.	This is the first elevator in the Punjab, if not in India, and a large sum was spent on experiments. If it is excessively expensive, lack of experience and of expert knowledge furnish an explanation. But there is a special reason for expensiveness, since Portland cement is largely employed in the construction and its cost is out of all comparison with the cost of cement in other countries where elevators have been erected. The case really illustrates the need of government cement works in the Punjab. (Sd.) H. J. MAYNARD.
14. Fume chamber in the Chemistry Block at Agricultural College, Lyallpur.	....	Estimates were for £50 per cupboard. Mr. Barnes, the Principal, pointed out that they could be imported from England for £25 each. The estimates were then reduced.	This seems to me merely a consequence of the impossibility of being an expert in every kind of construction. Such things had never been wanted in the Punjab before. (Sd.) H. J. MAYNARD.
15. Farm buildings at Narwala (Lyallpur).	....	Mr. Barnes carried out this work by special permission for Rs. 4,334, being 60 per cent. below the Public Works Department estimate (Rs. 10,000).	Mr. Barnes gave his own valuable supervision, which is not allowed for in the statement of cost. Moreover the style of the buildings was much simpler and cheaper than the Public Works Department contemplated. Still the style was quite good enough. (Sd.) H. J. MAYNARD.
16. Temporary <i>katcha</i> quarters at Hansi Agricultural Farm.	....	The Public Works Department gave a contract for Rs. 1,800 to a person who sub-let the contract for Rs. 1,000. As there was this margin, the estimate was presumably too high.	

The Hon'ble MR. H. J. MAYNARD called and examined.

4,525. (President.) The witness stated that he was the Financial Commissioner of the Punjab and that he had had 31 years' service the whole of which had been spent in the Punjab. He had no control over local bodies.

4,526. The executive charges of the Public Works Department were too large for effective supervision by the superior and subordinate staff and there was too much repetition and succession of supervision and too much examination in detail of the projects sent up by Executive, Superintending and Chief Engineers, but not enough of proper field supervision.

4,527. Superintending Engineers had too much office work. This left them little time for field supervision, and his experience as a Deputy Commissioner had been that the inspection of works by Superintending Engineers had not given very useful results. He could not state, however, whether the scrutiny of plans and estimates by Superintending Engineers served a useful purpose as an examination of these plans did not disclose what improvements had been made by Superintending Engineers owing to the fact that plans were very often the results of consultations between Superintending and Executive Engineers. He preferred not to commit himself to a definite opinion as to whether Superintending Engineers should be abolished and more specialists appointed in their stead at headquarters stations under the Chief Engineer. It was true that he had recommended in his written statement that there should be more men of experience at the central headquarters stations, but in doing so he had intended that Superintending Engineers should be retained for ordinary supervisory work, i.e., work which did not require the assistance of specialists.

4,528. A specialist might eventually be required in the Punjab for bridge work. There was, however, not enough bridge work at present in the Punjab to justify the appointment of a whole-time specialist in that branch. Only one important bridge had been built recently, but the construction of more bridges was contemplated. (Mr. Aikman here explained that bridges in the Punjab were not designed, as in some provinces, by large private

firms and that the designs for the majority of bridges other than suspension bridges in the hills were prepared by the Public Works Department.)

4,529. He also advocated the appointment in the Punjab of a rate and contract expert as he considered the arrangements for carrying out works were local in character and that there was not enough provincial competition for any particular work. Competition might be effective in the case of the larger works, but it was altogether absent in connection with the smaller works. The employment of a rate and contract expert would be justified inasmuch as that officer would possess full information regarding the rates in all parts of the province, and make it his business to study local conditions so as to determine the rates in different parts of the province. The Superintending Engineer was at present supposed to see that the rates in one locality were not much higher than in another, but the range of his duties was considerably larger than that of the proposed specialist as he dealt with a variety of questions concerning construction, administration, accounts, etc., whereas the attention of the expert he suggested would be solely directed to rates and contracts, and the collection of information from within and outside the province. He added that he thought, such an expert would be able to effect a good deal of economy.

4,530. The Public Works Department standard of work was higher than was necessary for ordinary requirements. There were standard plans for most of the buildings and this fact suggested to administrative officers a ready and easy method of disposing of questions concerning construction without paying attention to considerations of economy. It might be possible to construct buildings cheaper in several cases, but the existence of standard plans prevented the adoption of this course. It was not wrong in principle to have standard plans. But such plans however were only necessary and desirable for residential buildings, police stations, etc., and they should be subject to consideration in the case of every building that was erected with a view to see whether any economies could not be effected

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by modifying the design and whether the standard designs suited the particular site in question.

4,531. The functions of the Buildings and Roads and Irrigation Branches and the district boards overlapped as the staff of each worked in the same locality. He was opposed however to entrusting the irrigation engineers with any roads and buildings on the ground that they were already overburdened with work and it would distract their attention from their legitimate engineering duties. It was true that the province of the Punjab was favourably circumstanced for such an experiment owing to there being large irrigated areas which were co-terminus with the districts, but it was undesirable to try it as the irrigation engineers had already to attend to the canals and all the buildings connected with them besides the unmetalled roads. In addition they had a good deal of revenue work which absorbed their attention to a great extent. A further objection to the proposal was that the irrigation officers were running the Irrigation Department on commercial lines and that, if they were required to undertake the duties of a spending department like the Buildings and Roads Branch, it would prove detrimental to their management of the Irrigation Department as a profit making concern.

4,532. In order to obviate overlapping he suggested the formation of one service of district engineers instead of two as at present and stated that he would have suggested that the services of Public Works Department engineers should be lent to district boards, but doubted whether it was possible to rely upon these engineers being generally willing to accept such service. He also recommended that government should make over all its roads and buildings in the province to the district boards for maintenance with the exception of special buildings, e.g., museums and buildings at the provincial and district headquarters. Such an experiment had never, as far as he was aware, been tried on a systematic scale in the Punjab. Feeder roads had been and were still being made over to local bodies, however, but the results of this experiment had not been satisfactory, and it had proved a failure solely owing to the lack of proper supervision consequent on the inadequacy of the engineering staff.

4,533. He did not think that local bodies would be unwilling to undertake the maintenance of government buildings by reason of the fact that they were not directly interested in them and would consider it as outside their ordinary functions. On the contrary his experience had been that the district boards in the Punjab did not draw any distinction between their own work and government work and that they regarded both as *sarkari* work. Each class of work was as important to them as the other and the boards were inclined to attach more importance to government work than to their own. There was also no likelihood of the district boards representing that as their staff had been employed for local works only it would be too small for the execution of government work, as the scheme which he had suggested postulated a substantial measure of financial assistance from government to the boards, not only for the actual expenditure incurred on the maintenance of government buildings but also a reasonably liberal grant to cover the cost of establishment and incidental charges. The grants would be regulated according to the resources of each particular board, as their means of raising additional funds were strictly limited and the balance available after every necessity had been met was generally small.

4,534. The transfer for repairs to the boards of government buildings had been in vogue in the Punjab for many years and there had been a sort of contract for the repair of the buildings thus handed over even in the case of district *kutcheris*. The money spent in this manner had not been large and such special repairs as were required were not executed by the boards. All ordinary repairs, however, of almost all government buildings, except important ones such as the Lyallpur Agricultural College and other important educational buildings, were executed by district boards. (Mr. Aikman here stated that ordinary repairs of police stations were carried out by the Police Department themselves). The system had

worked satisfactorily though the district boards had often cause for the complaint that the contract allowance was not sufficient. The buildings were inspected periodically by Executive Engineers and no considerable difficulty had hitherto arisen between the boards and Executive Engineers as to the manner in which repairs had been executed.

4,535. A regular service of district engineers was essential for the success of the execution of government work by the boards, the appointment and transfer of district engineers being controlled by government. Such a service would be analogous to the system at present followed in the case of assistant surgeons lent to district boards under which the boards paid the average expenditure entailed by their entertainment and transfers were made from one district to another by government. This system had worked satisfactorily and no complaints had been made by the municipalities concerned. It was true that it was not an ideal one owing to the retention by government of control over persons who were paid by local bodies, but objections on this score could be diminished by paying reasonable attention to the wishes of the boards in respect to the posting of particular officers.

4,536. District engineers should be recruited partly in India and partly in Europe as there was not a sufficient field for recruiting Europeans in India. Partial recruitment in Europe was necessary to provide for promotions to the higher Public Works Department posts but if the service were intended only for the district boards recruitment might be confined to India. European engineers recruited in India by the boards had generally proved unsatisfactory. This was however not due to the smaller pay offered or to the fact that the conditions of service under local boards and municipalities were not sufficiently attractive for good men to join, as there were several good engineers employed by local bodies in the Punjab and one of the best engineers in the province outside the Public Works Department was in the employment of a municipality and another who was employed by a district board on Rs. 650 held charge of a district equal in extent to the charge of an Executive Engineer. The complaint that service under local bodies was troublesome on account of internal dissensions, interference in professional matters and the fact that an engineer had to serve several masters did not apply in the case of the Punjab. These drawbacks existed to a limited extent in the case of some of the municipalities, but the best of them were free from it.

4,537. If government roads and buildings were handed over to district boards, and funds for the purpose were made over, it would be necessary for government to exercise some form of control to see that money was properly spent. The present Superintending Engineers should therefore be retained for the inspection of district board works but their number might be reduced from three to two. He had not however given the question mature consideration. Hence his suggestion for the reduction of the number of Superintending Engineers was merely based on the assumption that as there would be a better agency for the execution of work a reduction in their number was feasible. It would be a better plan in principle, though more expensive, to attach one Inspector of Works to each Commissioner of a division, the real control over local bodies being vested in the Commissioner and the Inspector of Works being attached to his division as a professional adviser in all matters relating to the execution of work by the district boards. The Inspector of Works should in such a case be a man of better status than the district engineer and be given a salary somewhat less than a Superintending Engineer. As there were five Commissioners in the Punjab the employment of five Inspectors would be necessary.

4,538. Government at present possessed considerable powers of control over district boards under the District Boards Act, but it was rather difficult to exercise those powers. Real control would be exercised if government reserved the right to discontinue grants in the event of the wastage of funds by the boards, but remedial measures of surcharging or fining the boards in the Punjab

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were unnecessary as the boards were not difficult to handle and they were perfectly prepared to do as they were told.

4,539. Government had recently abandoned the idea of making grants to district boards for specific purposes, and had adopted the plan of making lump sum grants with the object of giving the boards greater liberty of action. All grants, including grants for education and public works, had thus been amalgamated into one sum. The change had been introduced in at least one division and it was proposed to introduce it generally. A certain degree of discretion was allowed to the Commissioner in the distribution of grants as they were placed at his disposal and he made allotments after taking into consideration the respective requirements of the several districts.

4,540. It was not possible to foresee whether there was any likelihood of official chairmen of district boards being replaced by non-official chairmen but public opinion, official as well as non-official, would be generally against it and though there might be some places in which there were competent persons to take the place of official chairmen, the Deputy Commissioner should continue to be the chairman in the majority of the districts. He added that the scheme he had proposed would be workable even in the case of districts which might eventually have suitable non-official chairmen.

4,541. The Deputy Commissioner was at present the *ex-officio* chairman of the district board and he did not think that if a non-official chairman were elected it would be feasible, in order to secure control over government funds, to make the Deputy Commissioner *ipso facto* a member of the public works committee of the board as it was inconceivable in the Punjab that the Deputy Commissioner should be a member of the board without being its chairman. If he were appointed a member of the public works committee he would exercise unlimited power.

4,542. He was therefore definitely of opinion that government roads and buildings should be transferred to district boards with the necessary funds subject to the outside control only of the Inspector of Works and the general control of the Commissioner, as it was inconceivable that there would be non-official chairmen appointed generally to district boards in the near future.

4,543. Too much detailed supervision was exercised by Public Works Department subordinates and this greatly discouraged private enterprise. The Department arranged for all engineering supervision which was not provided by contractors and which was not taken into account in calculating the rates at which work was given out. He was not in favour of the maintenance of a list of contractors classified according to their reliability and entrusting certain of them with works without supervision and others with work subject to supervision. All he advocated was that a large contractor might be entrusted with a whole work and expected to provide his own supervision, his rates being increased to cover the cost of such supervision. It was not necessary to have the same amount of supervision, as at present, in the case of large contractors to ensure structural stability and good work, as such contractors would have their reputation at stake and would therefore turn out good work.

4,544. He did not approve of the proposal that each department should be made responsible for the repairs to buildings it occupied, lump sum grants being provided for the purpose, as in effect it would simply mean the transfer of the work at present done by district boards to the Deputy Commissioner. He added that he preferred the system at present in force. (Mr. Aikman pointed out that the system of carrying out repairs on contract by district boards was not in force throughout the province and that it was in force only in a few districts.)

4,545. The proposal to reorganize the Department on a district and divisional basis and to have a Public Works Department officer in each district who should be brought into closer relationship with the Deputy Commissioner and Commissioner approximated, as far as the

district organization was concerned, to his proposal to make the engineer a district board engineer with the difference that even if the attempt to keep the district machinery efficient were abandoned it would have the advantage of keeping the Public Works Department in close touch with the Deputy Commissioner. The Executive Engineer at present was entirely independent of the Deputy Commissioner as he was very often in charge of three or four districts, and he was not considered as the professional adviser of the Deputy Commissioner as in the case of Forest or Police officers. The Forest officer was theoretically subject to control by the Deputy Commissioner and sent in his diaries to that officer and to the Commissioner. The Superintending Engineer was, however, wholly independent of the Commissioner.

4,546. The Chief Engineer in the Punjab was also Secretary to Government. He was the only head of a provincial department who was so situated as the other heads of departments, *e.g.*, Education, Police, etc., were subordinate to Secretaries. These heads of departments could submit questions in regard to appointments and other personal work to the Lieutenant-Governor but for purposes of general administration they had to submit cases through a Secretary to Government.

4,547. The complaint that the time of the Punjab Public Works Department was largely absorbed in preparing plans and estimates which never materialized owing to civil departments constantly calling for plans and estimates for new works for which funds were not, nor were likely to be, available for a long time was not universal. But there might have been occasional instances in which plans and estimates had been called for unnecessarily. It would not however be possible to rule that an officer should not requisition the Public Works Department for plans and estimates for projects unless he could certify that funds were likely to be available within a reasonable period, as it was impossible to foresee what allotments would be made. He could suggest no remedy for meeting the difficulty and considered that the matter should be left to the discretion of the administrative officers concerned.

4,548. The frequent revision of detailed plans owing to administrative officers changing their views was not prevalent to any great extent and he could not recall a single instance of such having occurred. No remedy was therefore necessary in this connection. If a Deputy Commissioner changed his views frequently and called for revised plans again and again he would be kept in check by the Commissioner, and if the latter officer likewise evinced the same propensity he would be kept in check by the local Government. The evil, in any case, was not a general one and was probably confined to a few individual officers.

4,549. (Mr. Cobb.) By the remark in his written statement that the "District Board is the Deputy Commissioner" he meant that the will of the Deputy Commissioner was the will of the district board. The boards did not exercise any influence on the will of the Deputy Commissioner and supplied the machinery through which the latter's will was carried out. Cases did not occur in which the will of the district board did not coincide with the will of the Deputy Commissioner.

4,550. He did not mean to imply that the district board did not afford much help to the Deputy Commissioner in their capacity as an advisory body; all that he intended was that the boards were not prepared to oppose the Deputy Commissioner. The relations between district boards and Deputy Commissioners were very friendly. The two worked in co-operation and the boards were useful partly as the agency for carrying out works and partly because of the excellent advice they offered in the framing of the programme of public works. They also performed useful functions as executors and supervisors of local work.

4,551. When a lump sum grant was allotted to a district board a portion of it was earmarked for establishment charges. The allocation of the remainder of the grant was then discussed at board meetings and the extent to which members of the board influenced the distribution depended almost entirely on their knowledge of

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the details and their capacity to put forward their views. The Deputy Commissioner did not definitely make up his mind as to the distribution beforehand and was ever ready to accept and supplement his own views by those of the board.

4,552. The method of execution of works adopted by local bodies was simpler than the cumbersome procedure of the Public Works Department and was quite effective in the case of small repairs.

4,553. (Rai Bahadur Ganga Ram.) In suggesting a specialist for bridges he had referred only to iron bridges.

4,554. He did not attach much importance to standard designs inasmuch as they had the tendency to limit the powers of officers to construct cheaper buildings. Though it was not possible to abolish standard designs altogether efforts should be made in every case to see whether economies could not be effected.

4,555. No money limit should be fixed in making over roads and buildings to the district boards, and the repairs to all buildings in the districts other than colleges and museums should be entrusted to the boards.

4,556. He did not desire to abolish the present system under which the designs of district board works were submitted to higher authorities for technical sanction, and advocated the continuance of the assistance at present afforded in this direction.

4,557. Two Inspectors of Works, instead of three Superintending Engineers, would in addition to the specialist engineers recommended in his written statement be sufficient for the inspection of the work of district boards.

4,558. Executive Engineers in the Punjab were *ex-officio* members of district boards, but they did not evince much interest in the proceedings of the boards and very seldom attended board meetings.

4,559. He preferred not to express an opinion on the question whether the F.A. standard would be high enough for admission to the Roorkee College.

4,560. (Mr. Mackenzie.) There was some dissatisfaction in the Punjab in connection with the present methods for the purchase of European stores as they resulted in great delays. He was of opinion with reference to the suggestion to appoint an official buyer in each provincial centre through whom all purchases would be made instead of through the India Office, that a man actually stationed in London would have access to various firms and have means of satisfying himself about all the pos-

sibilities and thus have advantages which a provincial buyer would not possess.

4,561. (Sir Noel Kershaw.) If there was a difference of opinion between the Deputy Commissioner and some members of the board as to the disposal of funds the matter would be settled by vote. There was no unwillingness on the part of the Deputy Commissioner to leave the matter to the discretion of the board and he was cognisant of only one case in which there had been a division. The Deputy Commissioner had been anxious in that case to see which way the decision would go, but had left the matter entirely to the discretion of the board.

4,562. Every item of expenditure was discussed and voted for, but grants were generally passed unanimously, the members being usually predisposed to follow the opinion held by the Deputy Commissioner. The Deputy Commissioner was only too glad to receive the opinion of members but as members generally did not consider the detailed distribution of the grants beforehand they were apt to follow the Deputy Commissioner's views. Members usually expressed their views freely on such questions as the importation of bulls for breeding cattle and their views were much appreciated by the Deputy Commissioner. The foregoing remarks, however, applied only to rural bodies and not to town committees. In the latter the elected members possessed a good deal of power and constantly followed their own will.

4,563. The scheme which he had suggested for the creation of a body of district engineers who would be appointed and transferred at the discretion of government would involve interference with the powers of district boards and in a measure retard the growth of local self-government. The three possible courses were (1) to aim at government works being executed by private contractors; (2) to adhere to the present system under which district engineers were recruited as opportunity offered; and (3) to recruit a general body of engineers under such conditions as would ensure the obtainment of good engineers for district service.

4,564. (Mr. Aikman.) District boards should be surcharged in cases in which roads handed over to them for maintenance, with a sufficiency of funds, had not been properly maintained, and where funds had been diverted to objects other than those for which grants were given. Such cases would, he added, however be rare. (Mr. Aikman stated that there had in the past been two or three such instances, and that in one case the funds intended for a road had been utilized for a hospital.

Supplementary written statement submitted by the Hon'ble Mr. H. J. MAYNARD, C.S.I., I.C.S.

Control of district boards.

4,565. Sections 44 to 55 of the District Boards Act, 1893, give certain legal powers of control over district boards to the local Government, the Commissioner and the Deputy Commissioner. If a district board makes default in performing any duty, the Commissioner may, by order in writing, fix a period for the performance of that duty; and in the event of further default, he is empowered to appoint some person to perform it and to require payment for the expense of performing it to be made. Another legal provision of importance is that "when the control and administration of any public work is by or under this Act transferred to a district board, and at the time of the transfer the cost of that control and administration is defrayed from provincial revenue, the local Government may invest any officer with respect to that work," with certain powers to ensure its satisfactory performance.

(2). Under Section 55 of the Act the local Government has power to make rules regarding budgets, forms of account, periodical audit, publication of accounts, preparation of plans and estimates for works, and the authority by which, and the conditions subject to which, such plans and estimates may be sanctioned. Under this legal authority, a collection of rules known as the

"District Board Account Code" has been prescribed for observance. Important features of this Code are:—

(a). The annual budget, accompanied by a statement showing the original works which the board proposes to execute during the year, must go to the Commissioner for orders; and, when passed by the Commissioner, must not be exceeded under any head without further sanction to transfers from one head to another. Government may at any time call for a revised budget, to be prepared according to instructions.

(b). A local audit of the board's accounts must take place once a year under the orders of the Accountant-General, and the board is bound to give every facility and assistance and to deal promptly with objection statements.

(c). Registers of works and measurements must be kept up and a completion certificate must be submitted before final payment for a work is made.

(3). There are also rules requiring the district board to obtain the sanction of certain authorities before undertaking original works of more than a certain value. These rules vary according as the district board is of the first or the second class. I attach* a copy of them as they stood on February 25th, 1916 (and still stand, I

* Not printed.

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believe). It will be seen that even a first-class board has to obtain administrative sanction before undertaking a work costing Rs. 5,000 or more. In practice administrative sanction is always given to projects when it is shown that they will serve a useful object and that there is no reason to doubt that the money for them will be forthcoming. Fair projects in detail are not prepared till administrative sanction has been given. Final or professional approval of the Public Works Department must be obtained by a first-class board before setting to work on a project estimated to cost Rs. 5,000 or more. These rather stringent rules would probably be relaxed if the engineering establishments of district boards were improved. I should call the rules an even greater limitation of local self-government than the insistence upon the employment of a particular district board engineer would be.

(4). Section 27 of the Act provides that if a board should appoint as its engineer (or as its servant in any other capacity) an unfit person, the Deputy Commissioner may (subject to an appeal to the Commissioner) call upon the board to dismiss him. No. XII-A of the rules (which is evidently a recent addition) goes a great deal further than this, and provides that the district board shall employ and retain such officers, and servants, and assign to them such pay, as certain Public Works Department authorities may consider necessary and proper; and requires the sanction of the same authorities to the appointment of persons to offices requiring professional skill. I have only now become aware of the existence of this rule; and I do not think that the courts would uphold its legality if it were questioned.

(5). Another important rule which is new since I last dealt with district board work is No. 12 (c) which empowers the civil officers to call upon certain Public Works Department officers to inspect and report upon district board works under construction. This virtually makes the Public Works Department officer an assistant of the civil officer for an important purpose.

(6). In the last report a local Government can (with the sanction of the Governor General in Council) supersede a board for persistent default (Section 51 of the Act). But these large powers of drastic action are less effective in practice than the knowledge that government can withhold grant-in-aid if they are not properly applied. I attach a copy* of the Review of District Boards for 1915-16, from which it will be seen that out of a total income of Rs. 74½ lakhs, government contributions under Education exceeded Rs. 11 lakhs and under Civil Works exceeded Rs. 12 lakhs and came to nearly Rs. 14 lakhs under other heads. If district board engineering establishments should be improved, as proposed by me, and provincial works made over to them on a larger scale than at present, these grants would become an even larger proportion of the total income.

(7). There is no power, at present, to surcharge to individuals, sums improperly expended from district funds, and the system is, in the Punjab, more appropriate to urban than to rural conditions. There is not, generally speaking, any eagerness on the part of rural notables to serve on district boards; whereas the competition for seats on municipal committees (urban) is sometimes keen.

4,500. *Possibility of finding suitable district engineers without establishing a regular service under government.*—It was pointed out to me during my examination by the Committee that my proposal for a provincial service of engineers, to be posted to district boards by a central authority, involves a serious diminution of the powers of the local self-governing bodies. I should like to say, quite plainly, that I regard any such diminution with much regret, and greatly prefer a solution which does not involve it. As I have said, there is no overt conflict of wills in a Punjab district board and what the board does is what the Deputy Commissioner thinks best. But there is, in an institution like the district board, always a potentiality of self-assertion. It is merely a question of the members, or some of the members, attaining to a

particular standard of knowledge and intelligence of public affairs. When that happens, the Deputy Commissioner will step down, or waive his own views, as he already often does now in his dealings with urban bodies. All that I say is that this particular standard of knowledge and intelligence has not yet been reached by rural boards in the Punjab. I have thought it necessary to make this clear, because the course of my examination by the Committee left me with the feeling that I had contrived to give the impression of depreciating self-governing institutions. One may regard an institution either as it is, or as it is likely to become. I certainly would not ignore the latter aspect.

(2). A district board engaging an engineer could never do, what government does, engage him for 30 years' service, or until the age of 55, with a promise of a pension at the end of his term. Having the need for only one, it must secure itself against the risk of hitting upon a bad one. The service must therefore be from year to year, or for a limited term of years, with, at most the prospect of a bonus at the end. Apart from this point, there is in India a social prejudice—a sort of analogue to the British snobbery of rank—in favour of service under government. Service under a district board lacks social prestige. Probably it even affects a man's social prospects, for instance when he addresses himself to the father of the lady whom he would desire to marry; when the question turns upon pay, prospects, and pension, and position upon the Government House list, or off it. These things being as they are, a local body must offer a salary substantially greater than government offers to secure a man of a particular standing and qualifications. If, as recommended by the Public Services Commission, government ought to give Rs. 380—750 for Assistant Engineers recruited in Europe, or Rs. 300—550 for the same class recruited in India, we must add 20 to 30 per cent. to these figures, to provide for recruitment by district boards. This 20 to 30 per cent. would not necessarily be given, or not necessarily all be given, in the form of salary. Part of it would take the form of bonus after so many years of approved service.

(3). If the proposal of the Public Services Commission be accepted, temporary engineers will henceforth be engaged in the Public Works Department only when it is imperative to engage additional assistance in order to cope with temporary emergencies, and it will be made clear that their engagements will be either for a specified item of work or for a limited term, in no case exceeding five years. This change may set free for district board employment a class of officer now not available for it. The Irrigation Branch in the Punjab employs nearly 60 such officers now, on salaries varying from Rs. 150 to Rs. 800 per mensem (the latter figure being attained after some 20 years of service). A few of them have English qualifications. The rest are presumably Roorkee men. No doubt they are all good men or they would not have been kept on. It appears to follow that district boards should be able to obtain the services of satisfactory engineers for Rs. 400 upwards; but, of course, the occasional and casual demands of particular local bodies, in a country where no private engineering practice at present exists, are not so likely to be satisfactorily met, as the comparatively steady demand of government embarking upon a great undertaking such as the Triple Canals project, which is presumably responsible for many of the temporary engineers employed in the Punjab Irrigation Branch. The facts given in paragraph 4,500 of my original memorandum (where the post carried a pay of Rs. 300—500) are not particularly encouraging.

(4). One obvious difficulty is this. Unless the district board is to take its district engineer straight from the engineering college at Roorkee, where is he to find employment in the beginning and how is he to acquire his experience? Possibly the Public Works Department might arrange to give a two years' training to young probationers, the cost being collected rateably from the district boards of the province. But this seems to involve some sort of guarantee of employment; and a guarantee of employment means the binding down of

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district boards, and interference, again, with self-governing rights.

(5). I suppose the matter may best be put in this form. The development of a district board engineering service, with engineers freely selected by each board is bound up with the creation of a private engineering profession. When the latter comes, and as it comes, the former may come too. In the meanwhile it is possible to do something by prescribing the qualifications and conditions of service for engineers to be employed by local bodies, and by providing the funds for increasing their pay, without going to the length of requiring them to take particular officers from a government list.

4,567. *Proposed rate and contract expert at headquarters.*—A private engineering profession will hardly come into existence in the Punjab unless it is the definite business of some one in particular to direct Public Works Department policy in that direction. This is one of the ways in which the headquarters rate and contract expert, proposed by me, might be expected to work. A department is not shaken out of a rut and put into a new course till its policy is placed in the hands of some one having a definite mission. It is a question of adjusting rates so that they may cover the cost of engineering supervision and of deliberately abandoning detailed departmental supervision of the kind now exercised.

(2). The question was put to me whether the proposed rate and contract expert might not naturally fulfil for the province the function which the Stores Department at the India Office discharges for India as a whole. I had not considered the point and I hesitated to answer.

RAI BAHADUR NARAIN SINGH, Contractor.

Written Statement.

4,569. (I). Economy and suitability of methods of execution of public works, and (II). Encouragement of other agency.—I beg to say that in my humble opinion the present method for the execution of civil works is a very definite and correct one, because at present a work is always under the supervision of a government officer from its beginning to its end. The officer concerned gets the work done, of the very best of its kind. He sees that good and first-class materials are used in the work. If any inferior material is brought on the work it comes at once to his notice and he gets it removed at once and superior material substituted. In short all details of the work and all sorts of materials come under his inspection for the whole time the work remains under construction. If any defect is noticed during construction, it is corrected then and there. When civil works will be entirely and solely entrusted for construction to private companies, I do not think that the same sort of scrutiny will be exercised by them which is now being done. Besides this the private companies will require 30 to 40 per cent. more than the present rates. It is my own experience of 37 years and I have personally noted on those occasions, where I had a chance of working side by side with private companies, that their rates were about double those of the Public Works Department contractors. I worked in the Lady Hardinge Women's Medical College recently; the rate of a European company for a reinforced concrete floor was Rs. 38 per 100 s.ft., whereas for the same kind of floor in the provincial works a local contractor was paid at Rs. 10 per 100 s. ft.

RAI BAHADUR NARAIN SINGH called and examined.

4,570. (President.) The witness stated that he was a Public Works Department contractor and that he employed a staff of overseers and sub-overseers trained at Roorkee or Lahore. He had, however, never employed an engineer.

4,571. The largest single contract which he had accepted was the construction of the Lady Hardinge Medical College and Hospital, Delhi, at a cost of about Rs. 14 lakhs. He was at present engaged on the construction of Government House, Delhi, which was estimated to cost about Rs. 93 lakhs. The contract had been given

I see in the suggestion the prospect of a great advantage to local industries; and from this point of view I welcome it.

4,568. *Position of the Chief Engineer as Secretary to the local Government.*—As in the Irrigation Branch, so in the Roads and Buildings, the Chief Engineer is a Secretary to Government. In the Education and Police Departments the departmental head is an Under Secretary to Government, and in the former at all events, exercises, I understand, functions very closely resembling those of a Secretary. This system (though it is carried even further in a small province such as the North-West Frontier Province, where the Revenue Commissioner is also the Revenue Secretary) is perhaps peculiar in a large province. It gives the departmental head (who figures sometimes as Government in such and such a department sometimes merely as the departmental head) large powers; and emancipates him from the closer control to which he would be subject if his work as departmental head were liable to the scrutiny of a Secretary before coming before the Lieutenant-Governor. Unless a Lieutenant-Governor is gifted with exceptional working powers, the system tends to be one leaving the professional department to control itself, subject only to the control involved in the financial limits imposed upon aggregate expenditure; a control very different in character from financial control over particular schemes. But consideration of this question tends to lead one far afield. One solution evidently is the establishment of an Executive Council, in which public works should be the particular concern of one particular Councillor.

Thus it will be observed that the private company's rate will be about four times the present contractors' rate.

(2). Under the present system of working hundreds of men of all classes (high and low) get their livelihood and pray for the prosperity and good of the government. When the work will be done by companies alone, they will get the work done, to the advantage of their own purses, by petty contractors and pay them at as low rates as possible, the big companies keeping as much of the profit as possible. I therefore cannot think that private companies will use first-class materials or use them in proper proportion in mortar unless a government officer is appointed for supervising the work and examining the material. If supervision by an officer is then found to be a necessity, it means a reversion to the system which is now in force.

(3). In the case of smaller works, private companies will not care to execute them and entrusting the works to small contractors will again require the employment of its own staff by the government. But if all the works, which are now being done under separate arrangements in the municipality, district boards and Public Works Department may be amalgamated and placed under one Chief Engineer, then economy in expenditure is possible without any prejudice to good work, as there would then be more scope for minimizing expenses. At present, this multiplicity of control entails the employment of a much larger staff, which can easily be reduced. The amalgamation will enhance the efficiency but reduce the number of the staff.

(4). In conclusion I would say that whatever system may be adopted for the execution of work, the contracts should invariably be given by open competition.

to him piece-meal, i.e., one storey at a time. He had so far taken up the contract for the first storey at a cost of Rs. 15 to Rs. 20 lakhs and hoped eventually to obtain the contract for the remainder of the building.

4,572. The present system of giving contracts was satisfactory as it provided for careful supervision by the Department which was as essential in the case of contractors as disciplinary control in the Army. He here instanced the case of a water-works scheme which was carried out without supervision by a large contracting firm and failed very shortly after its completion. The

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RAI BAHADUR NARAIN SINGH.

[Continued.]

periodical supervision at present exercised by the Executive Engineer, the sub-divisional officers who were always on the spot and overseers and sub-overseers who looked to the particular items of works, served a very useful purpose and was essential in the case of large firms. Firms charged high rates. For instance in one case a large firm had charged Rs. 38 per 100 sq. ft. for reinforced concrete flooring while the Public Works Department could have got the work done for Rs. 10 only by a petty contractor.

4,573. His experience had been that large contractors did not execute work themselves, but invariably sublet their work to petty contractors. The flooring he had referred to had been sublet to a local contractor.

4,574. He was in favour of the present contract system and did not desire any changes to be made. The employment of large contracting firms would be detrimental to the interests of the country as it would deprive a large number of petty contractors of their means of livelihood and prove uneconomical as government would then have to pay double profits to the firms as well as to the sub-contractors employed by them.

4,575. The present system for the execution of work was un-uitable in so far as it resulted in the employment of too many staffs and in consequence in a considerable overlapping of functions. He therefore recommended that the municipal district board and Public Works Department staffs should be amalgamated under one Chief Engineer, and that all the works, except irrigation, should be carried out by one government department.

4,576. The present system of giving contracts was

beneficial in that it provided employment for contractors, overseers, engineers and many other people. If the system of giving works to large firms were however introduced all the profits would go to a few firms and thus deprive a large number of people of their livelihood.

4,577. He could not suggest any changes in the existing system with a view to economy, other than the amalgamation of the district board, municipal and Public Works Department staffs nor did he think any changes were required from the point of view of contractors. He had worked in Delhi for the past seven years and had executed work worth about a crore of rupees and had always found the system to work satisfactorily. No change was therefore required at present, but there might be a necessity for some change 20 or 30 years hence.

4,578. (Mr. Colly.) Government at present employed a large staff and paid them reasonable salaries and if contracts were given to large firms, they would barely pay subsistence wages to their employees. A great number of people would thus suffer by the change. He admitted, however, that it would not lead to any loss to the labourers themselves. A further objection to the employment of large firms was that they would not take up scattered works at a distance from their headquarters.

4,579. (Rai Bahadur Ganga Ram.) He had worked as a contractor for about 37 years and had started with a capital of Rs. 6-12 only. He had served in the Army as a sepoy on a salary of about Rs. 5, at the time of the Kabul war, and had gradually worked his way up.

P. B. HEWLETT, Esq., ANGLICAN, PARTNER, MESSRS. LANE BROWN AND HEWLETT, Consulting Civil and Sanitary Engineers, Lucknow.

Written Statement.

Age 53 years. 4,580. Qualifications.—A retired Member Institution of Civil Engineers, England, since 1906.

1878. Articled to C. Claude Robson, M. I. C. E., and a student of Institution of Civil Engineers.

1899—1903. Student at University Engineering College, London.

Assistant Engineer with the Willerden District Council, London, engaged on various

1902—1905. sewerage works, notably, reconstruction of Brent Sewage Farm.

Appointed Resident Engineer to carry out Drainage Works with H. Lane Brown, M.I. C.E., as Supervising Engineer.

1905. Was taken into partnership by H. Lane Brown, M.I. C.E., and with him have prepared designs for and supervised

1907. construction of water-works, drainage and sewerage works for many cities in Northern India, vide Annexure.

4,581. (I). Economy and suitability of methods of execution of public works.—The evidence given in Allahabad by my partner Mr. Lane Brown in reply to this question represents my views also, and with further reference to the question of rates as distinct from supervision charges, I would like to say that from considerable experience in carrying out work by contract in North London, I have no doubt that satisfactory work is best secured by preventing, so far as possible, unfair or undercutting competition. Nothing but false economy can result from allowing undercutting of rates and I remark on this because, supposing open agency and contracting become an accepted fact, it might result in a worse evil than in paying the fairly full rates now paid by the Public Works Department.

(2). So far as the question of supervision charges are concerned, I cannot see any doubt that these would be considerably less if the Public Works Department supervision were remodelled on the lines of the inspecting staff of the Local Government Board at home.

(3). From my experience of the provisions of the Public Works and Local Funds Account Codes, these seem to have developed or accreted into a cumbersome and unduly expensive method of procedure, and it would not be

impossible, in my opinion, to radically change the system of accounts, to fall in line with the ordinary system of accounts for the execution of public works as in force at home.

(1). The real difficulty seems to be that of the unnecessary numbers of registers and other account forms, which it has become practically a life-long study to understand and comply with; with very few instances the engineer seems at the mercy of the permanent accounts staff whose interest is the continuance and extension of the provisions of the Code.

4,582. (II). Encouragement of other agency.—During the past four years we have been engaged in the Punjab, on the recommendation of government, in the preparation of designs and estimates for sanitation schemes for Lahore, Amritsar and Multan.

(2). The construction of a portion of the Amritsar scheme has been carried out under our supervision. This latter work has secured the approval of government, the local authorities and inhabitants.

(3). We have received every encouragement from the Public Works Department in the Punjab, but since the completion of the above works nothing further has been entrusted to us. We are not in a position to know whether this is caused by financial stress owing to the war or if the Sanitary Engineer's department is carrying out any works which may be in hand at the present time.

4,583. (III). Changes in organization and (IV) Relations with other departments and sub-branches.—I am unable to answer these questions which appear to be departmental.

4,584. (V). Decentralization.—If the design and execution of works at present carried out entirely by the Public Works Department, Buildings and Roads Branch, is to be thrown open in part or whole to private firms or agencies, then undoubtedly a considerable amount of decentralization would be necessary. Such a change, of course, could only be gradually effected. At the present moment owing to the whole of these works having been kept practically entirely in the hands of the government engineers and architects, there has been little scope for any private firms and thus few have been attracted to practice in India. Had such opportunity for practice been open, it is certain that a good number of efficient firms would have long ago been established and I am quite sure

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[Continued.]

that, if the Public Works Department, Buildings and Roads Branch were, as suggested in my reply to question (1), remodelled on the lines of the advisory and scrutinising staff of the Local Government Board at home, with suitable standing orders together with specifications, prepared and revised when necessary, the country would generally benefit from the stimulus of healthy competition and avenues of employment be opened to young engineers in the open market.

(2). It may be said that the amount of employment would not provide for a greater number, or possibly a less number of engineers and architects than are at present in government employ, but it should be remembered that for want of properly qualified firms the majority of private works of building, etc., undertaken in the country have perforce remained in the hands of the *mistri* and small contractor class with the result that a low standard of design and construction has been the general rule, and I consider that there is a considerable scope for these undertakings over and above any work now entirely in the hands of government engineers and architects.

4,585. (VI). Simplification of procedure.—Have no experience, question apparently departmental.

4,586. (VII). Education, and (VIII) Practical training.—From our experience the education at Indian engineering colleges, as at home, provides a fully sufficient equipment in theoretical work, but even if to this be added a so-called practical training, which is generally of about a year, the young engineer will take anything from three to five years on actual works of construction before he can reasonably be expected to have sufficient experience to assume responsible control of such construction, in other words, it will be a misnomer to term him a qualified engineer until he has carried out in responsible charge some work of engineering construction.

(2). This is in contra-distinction to the view which appears to be held by government, that an academic

qualification is sufficient to provide recruitment for engineering posts. Nearly all the qualities necessary for responsible control of works are absent from such examinations for qualification for employment as a government engineer, and as the passing of the examination by a sufficiently high number of marks provides the examinee with a permanent and pensionable post it seems evident that the cadre may possibly carry a certain number of members who may fail to "make good" on the actual test of control of work.

(3). The education of an engineer cannot terminate with the passing of his examination at college, and it would be better, I would suggest, to consider this as simply a qualifying test to recruit for a class of scholarship probationers who in a period of five years could be given full qualification after having been for at least three years in responsible executive control of works—his salary from commencement should be sufficient to maintain him respectably and honestly and be provided in part or whole by government as a scholarship.

(4). These scholarships should not be awarded for a paper examination only, other qualities, energy, physical as well as mental, are essential as are also tact and honesty and in awarding the scholarships the absence or otherwise of these factors should be fully considered together with the academic results.

ANNEXURE A.

Sewerage, surface drainage and water-supply schemes prepared and constructed by Messrs. Lane Brown & Hewlett, Consulting Civil and Sanitary Engineers, 1898 to 1914.

(For details please see Annexure B to the written statement of Mr. H. Lane Brown, page 194 ante.)

MR. P. R. HEWLETT called and examined.

4,587. (President.) The witness stated that he was a partner of Messrs. Lane Brown and Hewlett, a firm of Consulting Civil and Sanitary Engineers.

4,588. A system under which all public works in India ought to be left entirely to private enterprise, and under which government should merely employ a staff of experts for approving such works, was the idea partially underlying the suggestions in his written evidence. His main recommendation was that government should endeavour to carry out works more on the lines followed by municipal administrations in England and go even further and increase the scope of the staff which would correspond in such a case to that of the Local Government Board there but not undertake any executive work themselves. Every local body in England which was sufficiently large to carry out their own engineering work maintained an engineering staff. This applied however only to ordinary works, and a similar practice could be introduced in India. Large works, in England, e.g., tramway or electrical schemes, on the other hand, were invariably given to consulting engineers. This had been his experience when employed by the municipality of Willesden (one of the largest municipalities in England) in the county of Middlesex. That municipality did not employ their own architect, but had an engineer to whom he (the witness) had been attached. He had never seen any parallel between the system followed by municipalities in England and government work in India that might be of help to the latter in the execution of works. The suggestions in his written evidence did not apply entirely to government works but more especially to the works of local bodies. He had recommended that government should not assist such bodies by employing their Sanitary Engineer to prepare schemes for them, but that they should allow local bodies to employ private enterprise on such work. In his opinion the Sanitary Engineer employed by government should not prepare designs at all and his work should be restricted to the scrutiny of the designs prepared by private firms, inspections, and an examination of the necessity for the several schemes.

4,589. A certain number of sanitary schemes in the Punjab had been designed by his firm at a charge of 4 annas per head of the population concerned, and this charge was based on a system introduced by a Mr. Harriott in the Central Provinces. That officer had taken a certain number of towns in that province, for which sanitary schemes had already been prepared, and had found that the average cost of those schemes had been between Rs. 12 and Rs. 13 per head of the population. His firm's charge for designing work was 2 per cent on the cost of each scheme, and taking the figures arrived at by Mr. Harriott, this 2 per cent. worked out to practically 4 annas per head of the population. He admitted that the ordinary charge for designs made by consulting engineers was usually 2½ per cent., but explained that the firm had accepted 2 per cent. because at that time they had been given an immense number of projects to design for the Central Provinces Administration. The designs they had prepared had been approved usually by the Sanitary Board and not by the Sanitary Engineer to Government.

4,590. A portion of the Amritsar sanitary scheme had been constructed by his firm. The firm had acted during its progress as agents for the local municipality for a fee of 17 per cent. and carried out the works in that capacity, providing the whole of the clerical and technical staff necessary for the works, with the exception of that required for the embodiment of the accounts. The firm also provided a resident engineer who was fully qualified and had been trained in the London County Council offices. There were several contractors engaged on the Amritsar scheme, and contracts had been entered into between the municipality and the contractors, though his firm selected the latter. The municipality had entered into an agreement with his own firm for the payment of 17 per cent. on the cost of the work, and under this agreement the firm were permitted to let out the works to whoever they approved of. The fee of 17 per cent. was for construction, but in the case of the Amritsar scheme, although the design for the scheme had been

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[Continued.]

revised by his firm the municipality were not charged 10 per cent.

4,591. The municipalities in the Punjab were not at liberty to employ consulting engineers of their own to prepare schemes for them. He attributed the contention in his written evidence that his firm had not recently been employed on sanitary schemes by municipalities to the possibility that a large number of the municipalities had no knowledge of his firm's capacity to undertake such work, and added that unless a certain amount of encouragement were accorded to his firm by government it was not possible for such municipalities to be enlightened in this respect. Another contributory cause might be, that municipalities thought that it rather appealed to government that they should employ the Public Works Department, but he had no proof in support of this assertion. He surmised that some municipalities did know of his firm, since members of certain of those bodies had been to see the firm's work at Amritsar, and that they were reticent to extend their patronage to the firm for fear of offending the Sanitary Engineer to Government.

4,592. The Sanitary Engineer to Government should be prohibited from preparing designs for works, and government should maintain in the place of that officer a Consulting Sanitary Engineer whose duties should be restricted to the scrutiny of plans prepared by private enterprise; such plans as were rejected by that officer as unsuitable being returned to the firms concerned for revision.

4,593. (Sir Noel Kershaw.) In explanation of the position his firm had occupied in connection with the Amritsar sanitary scheme, he remarked that the contract for the actual execution of work did not really concern the firm. Their position was covered by an agreement, under which they supplied a resident engineer to the municipality and bore the expense incurred by the employment of that officer. The firm arranged for everything that was not actually chargeable to the work for a fee of 17 per cent., and let out the work on contract on behalf of the municipality. This 17 per cent. however included certain works charges in the shape of supervision of a minute character.

4,594. Daily labour work was only undertaken whenever it was not possible to obtain contractors to carry out the particular type of work the firm desired to be done. On such occasions the firm employed the labour and supervised the work, but the authority who had entered into an agreement with them paid the muster rolls. It was impossible to get contractors to take up cement work for drains and paving. To the contention that his firm's system left an enormous amount of power in the hands of the consulting engineers that probably did not obtain in any other country, he remarked that he believed that a somewhat similar system had been in vogue in some parts of America for a long time.

4,595. Since he had not been in touch with any work in England for about 12 years he was not able to state whether there were not a considerable number of small towns in that country that employed consulting engineers for works of a considerable size on a fixed percentage, which was not necessarily the percentage allowed under the rules of the Institution of Civil Engineers.

4,596. (Mr. Mackenzie.) The contractors usually employed by his firm were petty contractors, and unless specially desired the firm practically never paid them. The latter were generally paid by the municipality though the firm made out their bills. Losses due to the fault of contractors were deducted before their final bills were made out, and final bills were never prepared by the firm until a few months after the work had been completed. Further, contractors were never given large portions of a work, and they were not given more until they completed each portion. He admitted that if a contractor was not in a position to make good the expense involved by the commission of a fault, the municipality would undoubtedly suffer and would on their part attack his firm. But he had never known of a single occurrence of this nature as his firm took the precaution to give out only small portions of work at a time to each contractor. If a case involving litigation did occur, he thought a contractor might legally sue

the municipality but not his firm. If a contractor failed the firm during construction and the rest of the work in consequence cost more, he admitted that the firm's fees would be increased but added that in such a case the firm would probably forego the extra amount. Such a case however had never arisen.

4,597. In explanation of his firm's objection to taking contracts, he remarked that there were many reasons why it was very difficult for a European firm to work smoothly on a contract when there was a subordinate staff to supervise their work. His firm employed their own staff on works for which they were engaged and dismissed them on the spot if they accepted illegal gratification. The firm maintained a large staff of permanent sub-overseers whom they had had for a very considerable period, and also a head surveyor and head draughtsman. If his firm were to accept a government contract, they had also to accept the supervision of an engineer and sub-overseer, and they disapproved of their work being supervised by subordinates since they themselves were engineers.

4,598. (Rai Bahadur Ganga Ram.) A municipality which employed his firm to prepare a design for them was at liberty after receiving the design from the firm to employ whatever agency they chose on the construction of the work concerned. When acting as agents for a municipality, however, that body paid the muster rolls by giving his firm an imprest which the latter certified after payment. The municipality, as a rule, did not employ a staff for accounts since, except for their embodiment, the accounts were maintained by the firm. In the Central Provinces, however, the firm had borne the cost of a clerk on Rs. 60 or Rs. 70 to incorporate their accounts with the divisional accounts, but in connection with the Amritsar scheme the municipality had employed a man on Rs. 30 for this purpose. This was all the extra staff that that municipality had employed. The contractors engaged were paid not by the firm but by the municipality.

4,599. The designs prepared by his firm for the Amritsar scheme were, he believed, approved by the then Sanitary Engineer to government. This officer had on two or three occasions visited the work. The rest of the responsibility for the work, after the designs had been approved by the Sanitary Engineer, had rested on his firm.

4,600. (Mr. Cobb.) When at Willesden he had undertaken drainage works for which that municipality had not employed a consulting engineer. He remembered the tramway scheme previously referred to as the only case in which that municipality had engaged a consulting engineer, and he believed that that consulting engineer had also designed the scheme. The design had been submitted for approval to the municipal committee. He added that if in a busy town in England a complete new scheme were projected, it was the usual practice to employ a consulting engineer, but if merely an extension of an existing work was contemplated the work was generally carried out by the municipal engineering staff.

4,601. (Rai Bahadur Ganga Ram.)—It was not the case that his firm preferred to employ petty instead of large contractors when engaged by a local body on a fee of 17 per cent. to supervise a drainage work, but rather that they preferred to deal with those contractors from whom they were sure to get the best and cheapest work done. In view of the fact that it was practically certain that the tenders large contracting firms would put forward would be considerably higher than those of petty contractors, he did not think, if the former agency were engaged on construction, his firm could in any way reduce their fee.

4,602. (President.)—He agreed that the suggestions he had put forward for constituting a system for the execution of municipal works that might be a parallel to the system followed in England, might be practically crystallized in the following statement. If a municipality had a work which their permanent staff were competent to carry out, it ought to be executed by that agency, but if such a body had a work which could not be carried out by their permanent staff it should not be undertaken on their behalf by government, but should be given out to a firm of consulting engineers.

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MR. A. J. W. KITCHIN.

[Continued.]

A. J. W. KITCHIN, Esq., C.I.E., L.C.S., Deputy Commissioner, Lyallpur.

(Written Statement.)

4,603. The present system of executing civil works is wasteful in that there is so much clashing of departments. Personally, I entirely fail to understand why there should be separate branches of the Public Works Department for roads and buildings and for irrigation. The latter is generally reputed the more efficient and attracts all the best brains and acutest intellects, though perhaps it is not the most popular socially, and offers fewer amenities. If the two branches were amalgamated, there would be an enormous saving in expense and a great increase in efficiency. Of course all the divisions and circles would have to be re-made, but the saving would be so great that the number of divisions would be much less than at present. Moreover, irrigation officers would get an occasional change to different work and to better stations. All the best irrigation officers are accustomed to making both roads and buildings and would need no previous training before taking over such divisions. The existing roads and buildings officers would not indeed be much use in charge of irrigation circles, but the younger men at least could learn. It would be easier to get Sanitary Engineers and experts of all kinds from the combined Department than from the present small Department.

4,604. Half the clashing of administration which wastes so much time, pay and travelling allowance would disappear at once if this proposed amalgamation were

sanctioned. There remains the case of the district boards. It would pay government in some districts to give more work to the district boards and to contribute to the pay of the engineering establishment. But it would be unwise to make over more than petty works. District board engineering is more difficult than ordinary government engineering in that there is no professional control. Personally, I know of no really competent district board engineer who is not a pensioned government engineer. The ordinary private engineer would often do very well if he had an opportunity of learning his work under professional supervision. The district board engineers are under no such supervision, and for want of it they are not kept up to the mark and made to learn. The private engineer is generally inferior, not from want of natural capacity as from want of the prolonged control and supervision which alone turns able students into competent officers. Where is there anywhere a good private engineer, who has not learned his work in government service?

4,605. In my opinion there should be only one government engineering department and not several departments, officers should be encouraged to qualify for special appointments, engineering, sanitation, hydraulics, etc.; the district board engineers should be under closer government control and when possible government should assist by lending men or contributing to the pay of competent men.

MR. A. J. W. KITCHIN called and examined.

4,606. (President.) The witness stated that he was a Deputy Commissioner with 23 years' service the whole of which had been spent in the Punjab.

4,607. The several agencies employed for the construction of public works was the main defect in the present system. He had therefore suggested in his written evidence the amalgamation of the Irrigation and Buildings and Roads Branches, i.e., that each officer of the Department should be responsible for both classes of work in the area under his control. The objection to his proposal, viz., that the irrigation engineer had already as much work to carry out as he could possibly undertake and that he would be overburdened if he had in addition to undertake buildings and roads work, could be met by a re-distribution of divisions and would result in a considerable saving. As regards the further objection that if the irrigation engineer were given buildings and roads to construct that officer would become a less competent irrigation engineer and, similarly, if the buildings and roads engineer were given irrigation works to construct he would be a less competent buildings and roads officer, he contended that every irrigation engineer did, as a matter of fact, actually construct buildings and roads and that although it was probably correct that the Irrigation Branch constructed and maintained only unmetalled and unimportant roads, yet such roads were maintained more efficiently than those maintained by the Buildings and Roads Branch. Also that irrigation engineers generally had more experience in the construction of buildings since they were actually employed for years on masonry and earthwork construction and that they were therefore more familiar with the action of water on masonry and earthwork than buildings and roads engineers. Although such familiarity was not the only and most important requirement in connection with the construction of buildings, yet it had a great deal to do with it since the stability and structure of buildings largely depended upon their resistance to water.

4,608. District boards were competent to undertake petty repairs, but they should be restricted to such repairs, as the objection to their undertaking a higher standard of work was that the district engineer was at present not professionally qualified. His experience had been that there were no competent engineers other than government engineers. If the Lyallpur district, of which

he was Deputy Commissioner, employed a thoroughly competent engineer for all district and government works in its jurisdiction there would be sufficient work to justify his employment, as the present charge of the Lyallpur district engineer was fully equal to that of an Executive Engineer in the Buildings and Roads Branch of the Public Works Department, e.g., there were already two sub-divisions in the district. The district engineer in question would probably require the assistance of two Assistant Engineers if he had charge of both government and district board work. He agreed with the view that although a district board might be willing to pay as much money as government did at present to obtain the services of a good engineer, the board would fail to secure such an individual because of its interference with the work of the district engineer who had too many masters to serve and too many difficulties to overcome; but added that such views applied with greater force to municipalities than to district boards. He admitted, however, that competent engineers were employed by local bodies in other countries in the world and that the arrangement had proved satisfactory.

4,609. He did not wholly agree with the suggestion that government should hand over their roads and buildings to district boards, such work being supervised by a government Inspector of the status of a Superintending Engineer, as he considered that in some cases the amount of government work would be so overwhelmingly greater than the district board work that the district engineer would practically cease to perform his own legitimate work. The schemes might prove workable in the Lyallpur district, however, as the district board work in that district was more important than that of the Public Works Department, unless personal difficulties arose. The district of Rawalpindi, of which he had charge previously, was a poor one and its works were small. It was contemplated that a portion of the Grand Trunk Road in that district should be handed over to the board for maintenance but such a course, in his opinion, could hardly be defended. It was true that a government grant would be given to the district board for the maintenance of the road in question and that the district engineer would not have to serve under two masters, but only one, viz., the government Inspector of Works who would through the medium of inspection notes bring to light such defects as he might notice in its stand-

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Mr. A. J. W. KITCOLN.

[Continued.]

ard of maintenance and direct the board to carry out the necessary repairs failing which they would be penalized by a withdrawal of part of the grant; but the income of the district was roughly Rs. 1 lakh a year whereas the government grant to the Executive Engineer for the maintenance of the road might perhaps be Rs. 5 lakhs. Hence the actual earmarked allotment of the board and the amount spent on the maintenance of their roads would be so disproportionate that it was desirable that the district board should be placed under the Executive Engineer rather than the Executive Engineer under the district board. District funds were sometimes misappropriated, e.g., money allotted for the repair of a road was frequently not spent on it, and if an urgent necessity for an additional grant arose the boards often had not the money to fall back on. It would be possible, however, for government to enter into a contract with district boards and to allot an annual sum for the maintenance of roads, but careful audit would be necessary because, in the event of a breach in a road, caused by excessive rain, the district board would not be able to supply or make up the deficit and would have to fall back on government for an additional grant. He agreed, however, that if a ledger account was maintained in connection with such allotment by government, the fact that the local board had spent only, say, Rs. 9,000 out of an allotment of Rs. 10,000 would at once be apparent and that the balance of Rs. 1,000 could be placed in the current account for the following year's expenditure.

4,610. He did not think that local boards would be unwilling to enter into an agreement with government in connection with the allotment of funds for the maintenance of buildings and roads, regarding such work as outside their ordinary duties, but remarked that district boards had learned to look upon offers on the part of government to hand over works on a contract allotment with a good deal of suspicion. There would be no opposition by individual members of the boards but they in turn would probably be suspicious that the allotment would be insufficient for the purpose for which it was given.

4,611. District boards in the province were not sufficiently advanced and were therefore not suitable agencies for the construction of large public works and the control of the expenditure connected therewith. The district board of Lyallpur could undoubtedly take over public works buildings on a contract allotment but he believed that that board was the only one in the province which was capable of so doing. Its members were active and energetic, which could not be said of the members of other boards, and as its people had settled down in the district they had more opportunity of working in the public interests.

4,612. The district board of Lyallpur evinced an interest in the appointment of their district engineer and if a vacancy occurred at any time they would undoubtedly go into the question thoroughly. No appointment of district engineer had been made since he had been the Deputy Commissioner of the district, but if a vacancy occurred it would no doubt be filled with the advice of the sub-committee of the board who would examine all the applications for the post and perhaps seek the opinion of the Executive Engineer on the candidates, and try to obtain the services of the best man available. There would be no great danger of undue party influence since factional feelings would not enter into the question at all.

4,613. His district board took an intelligent interest in, and had a real influence over the programme of public works of the district; the roads and schools it was thought necessary to construct were discussed in full detail. Once the programme was settled, the district engineer prepared the necessary plans and estimates, and submitted them to the board for approval, and the sub-committee took an intelligent interest in such matters. The selection of contractors for the construction of works was left in the hands of the district engineer, subject to the approval of the Deputy Commissioner as chairman of the board; such matters were occasionally,

but not generally, discussed by the whole board. There was no unfair system in vogue in the Lyallpur district in connection with the giving out of contracts.

4,614. He believed that the Police Department in the Lyallpur district maintained its own buildings and that such maintenance was confined to such petty repairs as private persons were capable of undertaking. The Revenue Department could quite easily take over all the annual repairs to government buildings in the district, especially as that department was constantly arranging for the execution of petty repairs to buildings with the exception of those at headquarters. Such work was generally carried out through the staff of the district board, but sometimes by a *mistri* of the Public Works Department with whom contracts for the work in question were generally drawn up. He agreed that the Deputy Commissioner should be responsible for the annual maintenance of small government buildings in his district with the exception of buildings at headquarters and considered that by the adoption of such a system the work could easily be carried out, especially as such repairs were executed at present by backward districts in which no Public Works Department subordinates were available. The annual repairs to government buildings could be carried out by all districts, but even then the problem would not be entirely solved because there would be several large buildings the repairs to which required engineering skill. He preferred therefore that the maintenance of ordinary revenue buildings should be handed over to the Deputy Commissioner rather than to district boards.

4,615. If government buildings were handed over to district boards for maintenance such boards should not appoint their own engineering staff since, if competent engineers had to serve their lives in districts and ultimately rise to the higher posts of Superintending and Chief Engineers, service would necessarily have to be under government and engineers would be lent to district boards as was done at present in the case of the Medical service. The question however depended entirely upon what amount of assistance government were prepared to give. If the greater part of the time of the district engineer was to be employed on government buildings, then government had the right to see that competent men were employed. If, on the other hand, government fixed the minimum pay of the district engineer and laid down that that officer should be in possession of certain qualifications and that the appointment of the selected individual would be subject to the approval of the Commissioner on the recommendation of the Inspector of Works, the arrangement might prove satisfactory. The appointments of Inspectors of Works would be purely government appointments and such officers would be selected from Executive Engineers or be recruited from England. His suggestion that the appointment of district engineer should be a government appointment was based on the fact that a man in such service had to serve a number of years before he was entitled to a pension. If, however, a man was employed as a supernumerary engineer for 20 years he would perhaps be inefficient at the end of his service and if so could not earn a pension. District engineers in the Punjab were not pensionable; they subscribed to a provident fund similar to that of the railway. A provident fund would perhaps meet the point he had in view, provided that it was extended to Superintending and Chief Engineers.

4,616. The district engineer at Montgomery of twenty years ago received a salary of Rs. 40 a month and was well paid for his services as he had very little work to carry out. There was not sufficient work in the backward districts of the province to justify the appointment of a competent engineer. The district of Rawalpindi employed an engineer on a salary of Rs. 100 a month. That officer was quite capable of executing the work of the district, but the justification for the appointment of a high-class engineer depended a great deal upon how much a district spent on the construction of works. Hence the poorer districts could perhaps be left out of account altogether. They were as a matter of fact becoming less numerous, but he was not aware how the

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[Continued.]

introduction of the scheme for the appointment of their own engineering staff by district boards would appeal to engineers as compared with the present conditions. It would perhaps work well in his own district but there were many districts in which it would not work well. It would be a pity, in districts where different classes of engineers were employed, to lose the advantage of their proximity to works; in many places in his own district, works could be visited on certain days by the irrigation, buildings and roads and district engineers respectively and their combined travelling allowance would not amount to the travelling allowance of one engineer for the whole district, thereby resulting in a saving. The person whom he distrusted at present in connection with the proposal was the Deputy Commissioner; if that officer interfered too much there would be trouble, and if he did not there would also be trouble. There was at present a definite departmental link between the Superintending and Executive Engineer which would disappear if the proposal were introduced. He would rather combine the control and supervision since districts at present were suffering too much from departmentalism; the Sanitary Engineer's branch was a subsection of the Public Works Department and was rather difficult to deal with, and such a system was not an ideal one from the point of view of local self-government. The system might have worked well in other provinces, but he had had no experience of it.

4,617. (*Mr. Cobb.*) The struggle to misappropriate funds by district boards occurred rather at the time of expenditure than at the time of budget allotment. When the budget had been settled and grants were allotted for various purposes, there was no definite attempt to misappropriate funds. But it might happen that on the 31st March, the total sum under a particular head had not been spent, or that in the revised budget prepared in January it was found that there was an excess under one head and a deficit under another. He had known of cases in which grants for particular purposes had not been utilized at all for those purposes, but had been misappropriated to another head.

4,618. (*Sir Noel Kershaw.*) District boards looked with suspicion on government work being handed over to them because they were doubtful as to the adequacy of the allotment therefor. Such a contingency had happened only in very small matters and very few such allotments had been made. It had been his experience that the allotment for the maintenance by the district

boards of feeder roads had not always been adequate. Such allotment may have been adequate from the Public Works Department point of view, but the district board had never had an opportunity of seeing the figures in this connection. Although it happened very seldom, roads were sometimes handed over to the district board with a grant for their maintenance for a period of four or five years only and suspicion was naturally aroused in such cases. He knew of cases in which roads, with the allotted grants, had been made over to district boards and in which the grants had not been spent upon them, and this was of course the fault of the district boards concerned. Although he was not aware for what period of years government worked out the averages in connection with the grant of allotments, he felt that the roads had been handed over with allotments which were not adequate to maintain them up to the standard of repair expected by government.

4,619. Although the handing over of roads to district boards for maintenance was of infrequent occurrence, government had in some instances been generous in connection with the allotment of funds for their maintenance. Government gave a lump sum allotment for feeder roads and had also given a lump sum grant in connection with the works that had been transferred to other district bodies to which he had belonged. He believed that the district board expressed agreement in every case of the handing over of roads to them. If any large government works were made over to district board control, it was essential that the district board should have every opportunity of seeing the accounts before they took them over, and he had no reason to anticipate that such facilities would be denied.

4,620. It would be unwise to make over to district boards works other than petty works, as district board engineering was more difficult than ordinary government engineering in that there was no professional control. A man did not learn to be an engineer immediately, and no Public Works Department engineer would be appointed to the charge of a particular division until he had been in charge of sub-divisions for six or eight years and had gained considerable knowledge of supervision and was considered fit to hold charge of a district. The present district engineer required watching, but very little supervision would be required in the case of a really competent man. If men such as those at present employed in the Public Works Department were employed by district board, one of the gravest troubles would be solved.

F. W. K. YLONAN, Esq., Superintending Engineer, Public Works Department.

Written Statement.

4,621. (1). Economy and suitability of methods of execution of public works.—So far as the Punjab is concerned the present methods must be considered to be both economical and suitable. Many minor works and repairs could doubtless be carried out by other agency, e.g., by district boards, but in such case it is almost certain that supervision would not be so close and effectual as at present, and the quality of work would be inferior to that which is now done while the rates paid would remain the same. Any savings in supervision charges would probably be more than counterbalanced by an increase in the quantity and cost of repair work to be done each year, or, failing this, there would be a danger of works falling into disrepair.

(2). No one perhaps will contend that roads under the control of district boards are so well maintained as those under the Public Works Department. The district board or district engineer would perhaps explain the difference by saying that the Public Works Department had more money allowed. This, however, would not be a complete and sufficient explanation. Anyone can notice the difference in the condition and quality of road metal collected and used under the two agencies. District boards have no system of doing petty repairs to metalled coats or earth-work immediately such are required. This in the long run means greater expense and the result is that a road is rarely in good order for any length of time.

Probably more money can be wasted on the maintenance of roads than on any other kind of repair work done. Unless supervision is very close and efficient work is certain to be inferior in some way, and possibly work and material may be paid for which has never been done or supplied.

(3). A district board or a municipal engineer is practically the head of his department. He has no professional superior, and all detailed supervision of works carried out under him is done by subordinates who probably in some cases have had no adequate training or experience, and who are appointed by and may be dismissed by the engineer himself. The Buildings and Roads Branch at present is certainly the best if not the only practical training school for district board and municipal engineers which exists in the province. If the designing and erection of all new minor government buildings and the repair and maintenance of existing ones as well as roads are entrusted to other agency it is quite possible that the government engineering staff, which would have to be entertained for the design and construction of the more important works, would not always be fully employed, and in that case it is probable that the percentage charges for the more important buildings and works would, in the future, be heavier than they have been in the past. Also for each new large work a fresh temporary subordinate staff would have to be engaged which would not tend to efficiency.

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[Continued.]

4,622. (II). Encouragement of other agency.—Under the present system all work, with the exception of the supply of certain materials or stores which are supplied through the India Office, is carried out by private enterprise under the supervision of officers of the Public Works Department.

(2). If private enterprise would be encouraged by the discontinuance of professional supervision it is obvious that the encouragement would only amount to increased contractors' profits at the expense of the quality of work. The rules which require stores of European manufacture to be ordered through the India Office, perhaps, in some cases, lead to the employment of small contractors instead of firms with considerable capital. No doubt there were adequate reasons for these rules when they were framed, but since that time conditions have changed altogether. These rules, although they have been made somewhat more elastic in recent years, should be still further relaxed or abolished entirely. It should be permissible to purchase all materials and stores of European manufacture required for all ordinary purposes direct from firms having branches or agents in India. All that is required is that there should be sufficient guarantee for the quality of what is purchased and that prices paid shall be reasonable. If purchasing officers were permitted to order all stores from firms whose names were on a government list this would probably be a sufficient safeguard for the quality of stores supplied, as only firms with a reputation would be on the list. This change in the rules would, to a certain extent, be an encouragement to private enterprise in the country, but would make little or no local difference.

(3). Most government works are carried out by comparatively small contractors who have no professional training themselves and employ no trained subordinates. All engineering problems which may arise during the execution of a work are dealt with by the officers who supervise the work. It is believed that work carried out by small contractors under the above conditions will, in this country generally, always be better and more economically done than if large contractors with their own professional staff, tools and plant, etc., were employed. It is believed that no government in the world gets its important and large works carried out more economically than the Government of India.

4,623. (V). Decentralization.—In some respects further decentralization within the Department is desirable and the following suggestions are made:—

(a). Superintending Engineers may be empowered to sanction the purchase of live stock up to a value of Rs. 500, paragraph 285 of Public Works Department Code, Volume I.

(b). Executive Engineers may be authorized to sanction the purchase of office furniture up to a value of Rs. 50 provided the articles required are to replace others which have been written off the list under the Superintending Engineer's orders.

(c). The rules for the repairs to bungalows (paragraphs 917 and 919, Public Works Department Code, Volume I), appear to be restrictive and are also complicated. The rules should be modified so as to give Superintending Engineers full authority to deal with all cases on their merits.

(d). Superintending Engineers should have powers to dismantle old and useless buildings constructed from imperial funds up to a value of Rs. 2,500, and the present powers of local Governments should be correspondingly increased (paragraph 908, Public Works Department Code, Volume I.)

(e). Superintending Engineers may be invested with powers to reappropriate grants within the same departmental head, viz., under 42—Revenue and 49—Capital. For example, they should be able to reappropriate grants from 42 I.-A. to 42 I.-B. and from 49—Capital I. Works to

II—Establishment or III—Tools and plant under the same head.

(f). The rules for the local purchase of European stores, Appendix 30, Public Works Department Code, Volume III, appear to be unduly restrictive and complicated. Superintending Engineers may be given increased powers and Executive Engineers permitted to purchase stores from recognized firms up to the limit of their powers of sanction for works.

4,624. (VI). Simplification of procedure.—So far as the Irrigation Branch of the Public Works Department is concerned, and subject to the remarks on point (v), the rules regarding the execution and maintenance of civil works appear to be suitable.

4,625. (VII). Education.—The present system of education and standard of instruction in government engineering colleges is probably on a sufficiently broad basis and sufficiently advanced generally, but it is believed it does not offer sufficient facilities for specializing in particular branches such as electrical, mechanical, sanitary, irrigation or architectural engineering.

(2). To complete any engineering education an adequate practical course is essential, but none of the colleges insist upon such training before conferring degrees or diplomas. Very few colleges are themselves in a position to provide practical training, but arrangements might be made with certain selected engineers, railway workshops, or engineering firms, whereby students after successfully going through their college course should be required to undergo a practical training before degrees were conferred. Suitable candidates are probably attracted, but Indian candidates generally are averse to doing anything which may be considered to be manual labour, as they look upon such as being beneath their dignity and are inclined to think book-learning sufficient and all that can possibly be necessary. This aversion to use their hands greatly hinders their chances of employment by private firms, and also reduces their value as government engineers.

(3). An officer who is unable to do something himself is hardly fitted to explain to others how it should be done. An officer who has not undergone a practical training in workshops is hardly likely to be able to design satisfactorily proper details for structural iron-work.

4,626. (VIII). Practical training.—As mentioned in (I), the Public Works Department provides the only means for the practical training of young civil engineers in India, and most of those who receive their practical training in the Department have secured government appointments.

(2). In other countries a practical training is considered to be the last stage of an engineer's education and is absolutely necessary before he can expect to get remunerative employment. Like the college or scientific part of the education the practical training has to be paid for, and generally the expense is considerable.

(3). Should it be decided to entrust the construction and upkeep of certain classes of Public Works to other agency than departmental, e.g., to municipal committees and district boards, these agencies should be in a position to procure properly trained officers to supervise such works. Proper training can now only be got in the Public Works Department and to some extent perhaps in the engineering departments of the municipal services of some large towns.

(4). Young engineers who have obtained government appointments direct from college are naturally trained free of charge under government officers, but obviously it would not be fair to expect officers of the Public Works Department or municipal engineers to train outside young engineers without remuneration for doing so.

(5). It must be admitted that the provision for the practical training of students on works in this country is very limited.

MR. F. W. K. YEOMAN called and examined.

4,627. (President.) The witness stated that he was a Superintending Engineer of 30 years' service, the first

12 years of which had been spent in the Buildings and Roads Branch and the remainder in the Irrigation Branch

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[Continued.]

4,628. As far as he was aware no *pucca* road work had been undertaken by the Irrigation Branch in the Punjab, i.e., no metalled roads were maintained by that branch, but only canal, bank and country tracks. The Irrigation Branch, however, maintained its own buildings.

4,629. As the Irrigation Branch had already sufficient work of their own, he did not approve of the suggestion that irrigation engineers should take over all buildings and roads work. If the Irrigation Branch, however, were given the necessary staff it could take over the buildings in irrigation areas, but not the roads, as irrigation engineers did not possess adequate experience of road construction.

4,630. The view in his written statement that district board roads were inferior to those of the Public Works Department was based on his observation of both classes of roads. The difference in quality was principally due to insufficient supervision in the case of district board roads, but as he had no information in respect to the funds that the boards had at their disposal, he could not say whether lack of funds had in any way been a contributory cause.

4,631. His practical experience had been that large contractors could not carry out ordinary repair works at the same rates as small contractors. It was true that large contractors had certain advantages over small contractors in so far as funds and experience were concerned; but it was doubtful whether such contractors could provide more skilled workmen, since the agency both classes employed was usually the same. The supervision necessary over both large and small contractors was the same, and it was impossible to obtain the same quality of work with less supervision. He therefore disapproved of the suggestion that reliable firms of contractors might be advantageously employed with much less Public Works Department supervision. Government could not with advantage entirely trust their works to contracting firms.

4,632. He had not considered the classification of

contractors in the province according to their reliability, financial stability, etc.

4,633. He possessed powers of technical sanction as a Superintending Engineer up to Rs. 5,000.

4,634. Under the present arrangements, he could dismiss only such persons as were appointed temporarily by him. In respect to the revenue establishment, he was empowered to appoint and dismiss permanent members of the staff up to the grade of *munshi*. Additional powers over the lower subordinate staff would not make much difference if given to Superintending Engineers as long as there existed a right of appeal to the local Government.

4,635. The suggestion in his written statement to the effect that specialization ought to be increased in the Indian engineering colleges had reference only to those engineers who were being trained in special branches of engineering. Special courses, he considered, ought to be undertaken immediately after the general civil engineering course.

4,636. All students in engineering colleges should receive practical training and officers who undertook to train students ought to be remunerated for doing so by the students, except in the case of men who were intended for government service, the fees for such training being paid by the students monthly or in lump sum. Though such a system might not prove to be satisfactory it was advantageous in that students would be able to show that a practical training had been given to them. The remuneration for the practical training of students should be paid to the officer who had trained a student rather than to government, since it would involve additional work to the former and he would be responsible for what the students learnt and any defects in their training. As the works concerned [however] would be government works, and not the engineer's works, he suggested that government might as an alternative post the students to works and allow them to acquire their own experience.

At Lahore, Wednesday, 11th April 1917.

PRESENT :

F. G. SLY, Esq., O.S.I., I.C.S. (President.)

SIR NOEL KERSHAW, K.C.D.

C. S. COBB, Esq., M.V.O.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

And the following Co-opted Member.

D. W. ATKINSON, Esq., C.I.E., Chief Engineer and Secretary to the Government of the Punjab, Public Works Department, Buildings and Roads Branch.

D. G. HARRIS, Esq. (Secretary.)

Written Statement.

Memorandum embodying the views of selected officers of the Police Department, Punjab, on the present methods of the Public Works Department, Buildings and Roads Branch.

4,637. (I.) Economy and suitability of methods of execution of public works.—The consensus of opinion in the Police Department is that the Public Works Department agency is not economical, and is not always efficient.

Mr. C. STEAD, Personal Assistant to the Inspector-General of Police, Punjab, called and examined.

4,640. (President.) The witness stated that he was the Personal Assistant to the Inspector-General of Police, Punjab.

4,641. The Police Department in the Punjab carried out ordinary annual repairs, such as white-washing, etc., to all police buildings including the larger works at the

4,638. (II.) Encouragement of other agency.—It is considered that private agency should be more encouraged as this will probably stimulate healthy competition and tend to economy.

4,639. (V.) Decentralization, and (VI.) Simplification of procedure.—The present Public Works Department regulations are unduly complicated and restrictive, and the head of a department should be authorized to sanction works up to Rs. 5,000 being undertaken by efficient private agency, subject to inspection by the Public Works Department.

headquarters stations, e.g., the District Superintendent's office building. The department, however, did not undertake construction work though repair works were classed under the head of "Petty Construction and Repairs," and even their most minor works were constructed by the Public Works Department. This

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[Continued.]

system had in his opinion hitherto worked satisfactorily. Police buildings were generally inspected by the subordinates of the Public Works Department and members of the superior Public Works Department staff had very seldom undertaken such inspections. The Police Department did not utilize the services of private professional agency in carrying out their repair works nor did they invite the assistance of subordinates either of the Public Works Department or of district boards. The Inspector-General of Police personally was in favour of the retention of the present system under which police repair work was carried out.

4,642. The contention that the system under which the Police Department carried out repairs to their own buildings occupied an undue amount of the time of police officers to the detriment of their legitimate duties was exaggerated. Though the work in question did absorb a certain amount of the time of police officers, it did not constitute an undue tax on the time of district police officers to the extent that it interfered with their legitimate work.

4,643. No complaints had been received in the Punjab from the headmen of villages to the effect that police officers had had repair work carried out by improper methods, e.g., that wood had been taken from *zemin-dars* free of charge, or that such individuals had been called upon by the police to supply free labour.

4,644. Since, both in his opinion and in that of the Inspector-General, the annual repairs to police buildings had hitherto been satisfactorily executed without the guidance of professional supervision, he considered that the contention, that the building trades in India were too undeveloped to permit even ordinary repair work to be carried out efficiently without professional supervision, could not be applied to the Punjab in so far as the work undertaken by the Police Department in that province was concerned.

4,645. The sums allotted for repairs in each district were made over to the District Superintendent of Police who possessed discretion as to the allocation of the money between the several buildings. The rates at which repair work was performed depended on the prevailing rates in the neighbourhood. Allotments for repair work had originally been fixed at a standard percentage for each police station or other building, but when the municipal police were provincialized the Police Department took over a large number of buildings from municipalities and since then a lump sum had been allotted by government for all petty police repairs. This allotment was not absolutely constant but was calculated on the average expenditure during the previous triennium. He was not aware what percentage the money spent by his department on repairs bore to the capital cost of the buildings and he doubted whether it would be possible to obtain this information, since many of the buildings that had been taken over from municipalities were constructed before the British occupation of the province and their capital cost had not been recorded. In view of this fact, he was also unable to state whether the system under which the Police Department carried out repairs to their own buildings was more economical than that under which the Public Works Department carried out repairs.

4,646. The Police Department submitted contingent bills showing the manner in which the sums allotted to them for repair work had been spent. The department were not subject to the Public Works Department accounts rules but to their own accounts rules. Consequently detailed bills containing measurements, etc., were not prepared for the repair of police buildings.

4,647. The Inspector-General of Police considered that private enterprise ought to be further encouraged e.g., that minor works and special repairs might be carried out through private agency wherever possible. Such a course would save a great deal of correspondence and delay and would probably be more economical than the present arrangement. The Police Department should accordingly be at liberty to make their own arrangements for the construction by private agency of minor police works, i.e., works that involved sums less than Rs. 5,000,

in places where that department considered that an efficient private agency existed. The Police Department however had had no official experience of the system advocated, and had likewise not had experience of a system under which repairs to police buildings had been carried out by district boards.

4,648. The Inspector-General of Police, Punjab, had powers to accord administrative sanction to minor police works which were worth less than Rs. 3,600 only. But that officer desired to be empowered to accord administrative sanction, and to decide as to the agency which should construct minor police works which were not in excess of Rs. 5,000. The Inspector-General anticipated that if this suggestion were given effect to, it would result in economy in time.

4,649. A programme of major and minor police works which was arranged in order of urgency and revised every year was maintained in the office of the Inspector-General. That officer intimated the requirements of the Police Department in respect to works every year and the police grant was fixed according as to whether the requirements could be fully met or not. So far as the Police Department were concerned there was no system in force in the Punjab under which technical heads of departments and Commissioners decided how sums available for new works might be divided. A yearly list of police requirements was submitted and it rested with the local Government to decide how far those requirements could be met after considering the relative urgency of works of other departments.

4,650. The Police Department in the Punjab had occasionally called upon the Public Works Department to prepare plans and estimates for police works unnecessarily, but they usually contemplated works about two or three years ahead and did not insist on the preparation of schemes for a large list of buildings that might take 10, 20 or 30 years to complete.

4,651. All police buildings were constructed to standard designs and these were constantly undergoing revision. The standard plans for quarters for sub-inspectors were, for instance, at present under revision. The standard plans which had been designed for police buildings intended for public use had proved satisfactory, but those that had been adopted for sub-inspectors' and inspectors' quarters did not wholly suit the ideas of the Indian officers in occupation. Since there were considerable variations of climate in the Punjab and in the requirements of members of the several races who were ordinarily posted in districts as police officers, standard plans to meet such variations might be designed. With this exception the Inspector-General considered the standard plans in use in the province as suitable and necessary.

4,652. (Sir Noel Kershaw.) The system of providing free quarters for the police force had been in existence for about 10 years only. The fact that the quarters occupied by members of this force were all brick buildings did not place him in a better position to furnish the percentage that the sum spent on repairs bore to the capital cost of the buildings repaired.

4,653. In illustration of the Inspector-General's contention that the Public Works Department were not economical, he mentioned that that officer considered that the rates fixed by the Public Works Department were very arbitrary and high; in fact, that they were higher than those at which works could be carried out by a private agency.

4,654. If the powers of administrative sanction of the Inspector-General were increased to Rs. 5,000 for minor works, it would probably be desirable that such buildings as were erected by private agency should be inspected after their completion by the Public Works Department staff. But the Inspector-General would not in all probability allow a minor work to be constructed by a private firm unless the contractor in question was in a position to justify the patronage accorded him by the Police Department, by assuring that Department of his ability to perform efficient work. Hence the Inspector-General was willing to trust to the idea that private contractors would endeavour to qualify for future employment by the Police Department.

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[Continued.]

4,655. By the contention that the Public Works Department agency engaged during the construction of police works was not always sufficient, the Inspector-General implied that the superior staff of the Public Works Department was not sufficient to properly supervise such works and that supervisory duties were given too frequently to subordinates. In other words, that supervision was not exercised by a sufficient number of the more capable officers of the Public Works Department. He himself preferred the system the Inspector-General had recommended for the execution of minor police works worth less than Rs. 5,000 to the present system under which such works were placed in the charge of subordinates of the Public Works Department, and as an example of inefficient subordinate supervision he cited the case of the police lines at Dharmasala. These lines were rebuilt about three or four years ago but the Police Department were obliged within a few months of their construction to carry out most extensive repairs owing to the fact that the barracks had been built with a very low plinth and that no drainage had been provided.

4,656. (Mr. Mackenzie.) The police programme for future works was not very large and it had been reduced to less than the ordinary requirements owing to the war. There were at present only one or two large works awaiting the provision of sites. He added, however, that the programme had never at any time in his experience been very large. Last year's police budget amounted approximately to about Rs. 67,000 only for major works.

4,657. The Superintendent of Police inspected police buildings while on tour and settled with the sub-inspector as to what repairs should be carried out. The latter officer after receiving these instructions prepared a rough estimate regarding labour, cost of lime, mortar, etc. This estimate was then submitted to the Superintendent of Police for sanction and the provision of funds. Repair work was sometimes given out to petty contractors of the *raj mistri* type who were available in nearly every small town and district in the province. Generally, however, no contracts were entered into with these contractors and the sub-inspector in charge of each work purchased the lime, bricks, white-wash, etc., that was necessary and paid each *coolie* engaged on the work himself, the *raj mistri* supplying the technical knowledge.

4,658. (Rai Bahadur Ganga Ram.) Though the District Superintendent of Police frequently checked work that had been carried out by sub-inspectors under his charge, it was not his invariable practice. Measurements were not taken when submitting the accounts to the Accountant-General and only a bill stating what amounts had been spent on the several items of repair work with the necessary vouchers and receipts were submitted. Cases had occurred in which money allotted for repair work had been diverted to additions or alterations to buildings, but this was not the general practice and whenever funds had been so diverted action had been taken against the officers responsible.

4,659. Inspectors and sub-inspectors of police did not pay rent but were provided with free quarters. The

quarters of a sub-inspector were worth about Rs. 4,000 and the pay of these officers ranged between Rs. 50 and Rs. 100, their average pay being about Rs. 70. It was only right that a rule should be framed fixing the estimated accommodation of particular classes of quarters, as shown by the standard plans, in such a way that if rents were charged these rents should not exceed 10 per cent. of the officer's salary under the Public Works Department Code rules, but it would not be practicable to enforce such a rule. Certain standard plans did not suit Oriental ideas more especially in connection with the sanitary arrangements, i.e., the bathroom accommodation, and the Police Department were considering the point in consultation with the Government Architect. Standard plans of other provinces had not been referred to in connection with the preparation of standard plans for the Punjab.

4,660. The Public Works Department rates were high, not in comparison with the rates of the Police Department, but in comparison with those of private firms. As an example he stated that four or five years ago a certain Superintendent of Police had had a good police station erected through private agency according to a standard plan at about half the cost of the Public Works Department estimate. This case, however, was an extreme one.

4,661. The barracks at Dharmasala, to which he had previously referred, was a major work, and hence was not among the class of buildings that he had suggested might be constructed by the Police Department. Major police works in his opinion ought to remain in the charge of the Public Works Department.

4,662. (Mr. Cobb.) Repairs to police buildings were as far as possible undertaken as the necessity for them arose and there was usually no great delay in this respect. This however depended on the length of time taken in submitting the necessary papers for orders. Every police station in the district was ordinarily inspected at least four times a year and probably more frequently.

4,663. He approved of the suggestion that departments might be charged a certain percentage on the estimated cost of such schemes as were prepared for them by the Public Works Department and for which funds were not likely to be available for a considerable length of time. Such a system would prove most salutary as it would have a tendency to check the demand for schemes which probably never materialized.

4,664. (Mr. Ailman.) The average cost of petty annual repairs to a police station outside headquarters was about Rs. 20 or Rs. 25. If fault were found with a repair work, the sub-inspector or inspector responsible had to make the expenditure incurred good.

4,665. The Police Department had at present about Rs. 3 or Rs. 4 lakhs of major projects, which had been technically sanctioned, pending owing to the want of funds. His statements regarding charges in procedure recommended, however, had no reference to major works but to minor works.

THE HON'BLE MR. J. CURRIE, President, Punjab Chamber of Commerce.

THE HON'BLE MR. J. CURRIE called and examined.

4,666. (President.) The witness stated that he was the President of the Punjab Chamber of Commerce and that he came to express his personal views as he had not consulted the Chamber in the matter.

4,667. His firm was principally a commission agency and they had practically no relations with the Public Works Department. They were agents for a certain Indian cement company.

4,668. He advocated that all stores, other than those of a special nature, should be purchased in India if they were obtainable and was of opinion that most building materials could be procured in the country, e.g., steel structural materials, limes and cements, and that they were all of standard quality. There were sufficient firms in existence especially at Bombay and Calcutta to preclude any possibility of monopolies.

4,669. His firm supplied cement to the Railways, the Military Department and occasionally also to the Public Works Department. A great deal of cement was at present indented for on the Secretary of State for all large contracts as the desired quantity could not be turned out by the present cement plants in the country. It had not been his experience, however, that cement manufactured in India was more uneven in quality and unreliable than that imported from the Secretary of State. The cement company he represented had a properly equipped laboratory for the testing of cement, a qualified burner and also a qualified manager, and the plant had cost Rs. 20 lakhs. His firm invariably intimated to their customers that if they had any doubt as to the quality of the cement they supplied they could have it tested at the Government

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Test House at Alipore, and that if such a test produced unsatisfactory results or showed the cement was below the British standard the firm would take back the cement purchased.

4,670. In his opinion all government departments should first satisfy themselves, before indenting on the Secretary of State for stores, that the required materials were not procurable in India at reasonable prices.

4,671. The Public Works Department should advertise and invite tenders for all works of any magnitude. This practice was as a matter of fact followed in the province, but the contemplated construction of works should be made more generally known by freer resort to the insertion of advertisements in the newspapers.

4,672. It was desirable for the encouragement of small contractors to split up large contracts into parts rather than to call for tenders for entire works. Large firms would probably complain if this were done that they were thus debarred from taking up whole works, but the amounts of the estimates of the small contractors could be totalled in order to ascertain whether their total indicated that it would be cheaper to entrust a particular work to one contractor. The main object in view was the encouragement of private enterprise and this could only be secured by encouraging the Indian youth of the day to take an interest in particular classes of contract work. He was not aware of the number of reliable private contracting firms in the Punjab. The building trades were represented in the Chamber of Commerce, but they were more or less labour contractors only.

4,673. He entirely agreed with the suggestion that the Public Works Department should classify contractors into two or three classes according to their capacity and reliability in order to encourage private contracting firms. A reliable firm would need less supervision than a petty firm and hence should be given the benefit of the money which would otherwise be spent on supervision. Although the main difficulty in giving effect to the proposal would be the placing in the hands of the Department the somewhat unpleasant duty of deciding whether particular firms were reliable or not its introduction was feasible. The classification of contractors would not only assist government engineers in all provinces, but it would also act as an incentive to honest contractors. One of the disadvantages experienced by good private enterprise in the country was the excessive supervision of Public Works Department subordinates.

4,674. Government might call for plans and designs from private architects and remunerate them for their labour, but it was inadvisable that government should dispense with the services of their official architects at present. When he was the non-official chairman of the Karachi Municipality the municipal engineer was the architect. In his opinion private individuals received a great deal of assistance from officials in the framing of designs and estimates.

4,675. He was at present resident in Delhi where there was a great deal of building work in progress by contractors and others who were engaged on the imperial works, but the designs of the buildings being constructed in the city were simple and architects were not employed on them.

4,676. (*Mr. Cobb.*) He had been president of the Karachi Municipality for four years during which period the municipality had constructed about Rs. 10 lakhs worth of buildings through the agency of their own engineer. No advertisements had in this connection been inserted in the newspapers but tenders were called for and the work was supervised departmentally. The rates of the municipality were, he believed, lower than those of the Public Works Department because they had more local experience.

4,677. He was not averse to the employment of large contractors, but considered that the country would develop more rapidly by the employment of petty contractors who were not merely suppliers of labour. The Public Works Department very likely found that they could get work executed more cheaply at present by the

employment of labour contractors under departmental supervision than by the employment of large contractors, since labour contractors were not yet sufficiently advanced.

4,678. (*Rai Bahadur Ganga Ram.*) One of the duties of the Chamber of Commerce was to help trade, the building as well as others. But the Chamber could not possibly be expected to give financial aid. The interests of the building trade certainly came within the purview of the Chamber, but the trade had not developed to a sufficient extent to necessitate special arrangements being made for helping it. Several members of the Chamber were connected with the building trade.

4,679. The cement purchased from the company with which he was connected was despatched in covered wagons in bags made of good fabric but the bags were not water-tight. These bags were always kept under cover and not exposed to rain in which event, however, the material would perhaps deteriorate. As a matter of fact cement kept in barrels which were exposed to rain would also deteriorate, but comparatively speaking it was believed to be more secure in barrels. People who hesitated to buy cement in bags took an excessive precaution. Probably the bazaar could supply barrels only as long as they were in stock, but the difficulty in India was their excessive cost. The manufacturers of Katni and Bundi cement would, he believed, willingly adopt the barrel system if they could obtain barrels at a reasonable cost. Bundi cement would not deteriorate in bags so long as the bags were kept dry. In the sales of cement his firm were guided by the capacity of the works to supply. The present output had as a matter of fact been over sold.

4,680. (*Mr. Mackenzie.*) He had not compared the rates of the Public Works Department with other rates, except as a check to rates given in tenders, when he was in Karachi. The rates of the municipality of that town were always more favourable than those of the Public Works Department. This was due to the supervision of the municipal engineer and his knowledge of local conditions.

4,681. (*Sir Noel Kershaw.*) It could not generally be asserted that when the Public Works Department bought materials from outside merchants they were charged from 20 to 25 per cent. more than they would have been had they purchased such materials from England. If the practice of obtaining all materials from England were adopted and the Department purchased articles from firms in India only when they ran short, he did not think that the firms in question would put up their prices on that account. They would probably only add to the cost of the materials their charges for storage, railway freight and a reasonable profit. A charge of 25 per cent. more than that for which materials could be obtained from England was very extravagant, particularly in normal times, as with the available railway facilities there was not a point in India in which it was not easy to obtain quotations from at least half-a-dozen markets. He could only explain the fact that the charge of 25 per cent. in question had been made over and above the sum paid for such materials in England by classifying the man who quoted such a price as a rapacious individual. Probably the man had not been in the habit of receiving orders from the Public Works Department, had not sufficient turn-over and made the most he could out of the opportunity. Such a procedure on the man's part was dead against the interests of the country.

4,682. (*Mr. Aikman.*) Lists in which contractors were classified were already maintained in the Punjab. These lists were private and were not officially recognised. It was understood that they were kept by four or five of the best Executive Engineers of the province and the tenders of the contractors included therein were given preference.

4,683. The price of Bundi cement was Rs. 65 per ton free on rail at works. This price had not been fixed with reference to the price of cement in other provinces. His firm had offered to supply the Government of the Punjab with Bundi cement at a very much reduced rate.

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[Continued.]

W. S. DORMAN, Esq., M.I.C.E., Executive Engineer, Public Works Department.

Written Statement.

4,684. The Committee has been appointed to inquire into and report upon the organization and administration of the Buildings and Roads Branch of the Public Works Department, with certain specific points of reference which will as far as possible be dealt with *seriatim*, in as far as the writer feels he can offer any useful suggestions from his sixteen years' experience of the working of the Department.

4,685. (I.) Economy and suitability of methods of execution of public works.—At present all original government works and practically all repairs in the hands of the Department are executed by contract through local men. Direct departmental labour is only employed on work which cannot easily be measured or where suitable contractors are not forthcoming, as for example on some of our hill roads.

(2). Government work is designed by Public Works Department officers to the requirements of the Department concerned and, when it has been finally sanctioned and funds allotted, contractors are invited to tender for its execution on estimates prepared by officers of the Public Works Department.

(3). Contractors have rarely any technical knowledge, and not only has the Public Works Department officer to supervise everything from clearing the site to the last coat of paint, and generally to arrange for all European stores, but it is the almost universal rule for government to provide all tools and plant necessary for carrying out the work.

(4). Rates are overhauled annually so as to keep pace with the markets and a gradually rising scale of wages.

(5). The surface work on the maintenance of all trunk roads, i.e., through lines of communication, is done by direct departmental labour, on a scale laid down in road tables which are periodically revised as found necessary in order to meet varying traffic requirements. I am informed that some years ago the roads were given out on contract, but in a very short time they got into such a state that they took years to recover, and the Murree road is still cited as an awful example of what can happen to a neglected road.

(6). Collection of metal, however, and to a very large extent consolidation as well, is done by contract under close departmental supervision.

(7). Upkeep of buildings, as already mentioned, is done practically entirely by contract, and we merely see that the repairs are properly executed and measure up the work for payment. Formerly the preparation of annual repair estimates, etc., and the subsequent measurement of the work, meant much labour, which has now been minimized by the more universal adoption of stereotyped estimates and standard measurement books.

(8). The system as briefly outlined has proved suitable to the needs of the province and, considering the scattered nature of much of the work, it is also economical with sufficient funds forthcoming to keep the establishment fully employed. Before the outbreak of war, with steadily increasing funds available for expenditure on public works, the establishment charges had dropped to 13½ per cent. on the actual works outlay, and this takes no account of a vast expenditure of time and labour in working out schemes, which are never carried through, as well as professional advice rendered to native states, other departments and local bodies, for which no charge is made. As an example it is open to any Deputy Commissioner to call upon the Executive Engineer for proposals to improve the accommodation in his *kutcheri*. The cost involved may be comparatively small, but even though only rough sketches are demanded in the first instance, the preparation of these takes up a good deal of time. When his proposals are ready the Executive Engineer possibly finds that the Deputy Commissioner who originated the proposal has been transferred, or the Commissioner is not prepared to agree, and the scheme is dropped. No credit is given to the Department for the time taken up in the preparation of such schemes. If

this work were done by a practising architect he would be entitled to charge 1½ per cent. for his preliminary sketches and designs. Projects are frequently advanced a step further. The original proposals of the local officer may be administratively approved and detailed working drawings may be prepared but even then the project may be indefinitely shelved for want of funds. The Public Works Department gets no credit for such work, but an architect would be entitled to claim 3½ per cent. of the estimated cost of the work as his fee.

(9). The establishment percentage based on actual expenditure on works also covers a good deal of miscellaneous work, in the way of demarcating boundaries and checking government land plans, assessing rents, scrutinizing drawings and estimates prepared by local bodies, and preparing detailed projects for work suitable for famine labour in the event of a severe famine necessitating relief works and so on. Last year's printed famine programme includes public works amounting to more than a crore and a half of rupees.

(10). The Government of India laid down in Circular No. XX. P.W., dated 29th September 1881, that "for the future the basis for the rate to be adopted for the use of establishment shall be the proportion current for the cost of the establishment of the General Branch of the whole of India, to the outlay on the works and repairs of that branch, and that, for the present, the rate is 23 per cent." This rate, however, applies only to work executed for imperial departments or for private bodies. When work is carried out for a local body (municipality, district board, etc.) the Department only levies 12 per cent. and sometimes waives all departmental charges, with a resulting enhancement of the average establishment percentage whenever this happens to be running high and we have much work on hand for local bodies.

(11). It must always be remembered, in comparing establishment charges in India with those in western countries, that the rates for Indian labour are considerably lower than for western labour, while much of the supervising staff is a comparatively highly paid, imported article. Also that contract labour in the west is directly controlled by a class of highly skilled foremen employed by the contractors, such as is not obtainable in India—the result being that the government engineer has to devote much of his time to small details if he wants to get a satisfactory result.

(12). Another point is that in his office the Executive Engineer has to devote a large, and now constantly increasing proportion of his time to accounts work. He has not only to keep a record of his expenditure, but also to compile his accounts in a form suitable for incorporation with those of the Indian Empire. His compilations then go to a central audit office, where they are subjected to close scrutiny by officers trained to administer the letter of a Code and not its spirit. The cost of the accounts establishment in his own office and a certain proportion of the cost of the central audit office is reckoned in the cost of the Public Works Department establishment, all of which further tends to swell the establishment percentage.

(13). It has been argued that a permanent cadre does not readily admit of contraction of establishment in years of financial stringency, but it must be remembered that about an eighth of the buildings and roads superior grades in the Punjab are temporary Engineers, liable to dismissal at a month's notice, and that even in lean years, with establishment charges running abnormally high for want of constructional work, we have never been able to appreciably reduce our temporary men. During the present time of trial, the Buildings and Roads Branch has proved a valuable recruiting ground for military service, while in normal times it furnishes employment for a number of Royal Engineer officers, of whom we had seven on our small cadre at the outbreak of war.

4,686. (II.) Encouragement of other agency.—Under the existing system private enterprise is freely encouraged whenever specialists are to be found for any class of work. The building of our steel bridge girders

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and roof trusses, as well as such work as gas, electrical and hot water installations, plumbing, the provision of refrigerating plants and electrical lifts, are all carried out by firms specialising in these lines.

(2). Could a private firm be found to take up our general construction and maintenance work, it would probably reckon on 20 to 25 per cent. to cover its establishment, plant and margin of profit, while the various schemes of development which never fructify, but which are propounded for the amusement of the Department from time to time, would all be charged for separately.

(3). Rates would certainly not be less than those on which we estimate, but on which we can usually get the local contractor to give a rebate, and which compare very favourably with those paid by the Military Works, and on Railways, etc., when we work side by side.

(4). Last year when I held charge of the King Edward Memorial, with, according to the Administration Report, a works outlay of Rs. 10½ lakhs which was rather more than a quarter of the total outlay for the whole province on original works and would have been still more had the cost of the English stores actually used on the work been included, had we been able to get our measurements completed before the end of the financial year—the establishment charges only amounted to 5½ per cent. on the actual building; whereas in response to the public advertisement in the newspapers for the work, the only European contractor who tendered asked for 30 per cent. increase on the estimated rates. By distributing the work amongst a number of local men, we not only encouraged local industry, but also got the work done at 3 to 5 per cent. below our estimated rates. The establishment employed on the King Edward Memorial in addition to supervising the actual work in progress, had much concurrent designing, in recasting, from one reason or another, sanctioned proposals, and in preparing working details, as well as the completion plans of each building as finished.

(5). A private firm might have been glad to take up a concentrated work of this nature, but I doubt whether one could be found to take up work scattered all over a huge province, unless guaranteed a minimum expenditure for a number of years to make it worth its while to collect and train a competent establishment—an establishment not only able to carry out the work, but also conversant with the special requirements of other departments of government or embodied in various departmental manuals.

(6). Incidentally, the employment of any such agency would put up the rents of all government buildings, as the direct percentage charge on their construction and maintenance could hardly continue to be ignored in the Capital and Revenue Accounts.

(7). A private firm would naturally have its own interests at heart and the tendency would be to encourage extravagancies, with a view to increasing the outlay and thereby augmenting its own earnings.

(8). Side by side with government engineers are district engineers, in charge of the less important roads and buildings erected by district funds, often supplemented by government grants; also of a certain number of provincial buildings, for the upkeep of which grants (including a percentage for establishment) are made to the boards. These grants are usually fixed for a period of five years, and revised at the end of each quinquennium.

(9). This involves a certain amount of overlapping, inasmuch as while the district engineer may be giving the annual coat of white-wash, the Public Works Department officer may be enlarging a window, or putting in a new door or doing some special repair, i.e., sometimes making good what has resulted from years of neglect by the district board. This is obviously wrong. If the two agencies are to be maintained, either one or the other should be entirely responsible for all work in connection with a building.

(10). At the same time it is no economy having the two agencies working side by side. The district engineer is often little better than a subordinate; is usually not a highly paid individual; and in practice is liable to be

dismissed at the whim of the Deputy Commissioner of the day.

(11). The effort to bolster up district board funds for public works, by handing over to the board for maintenance with an establishment grant to help to cover the district engineer's pay, government buildings, which are often more frequently visited by a Public Works Department official on his rounds than by the district engineer, is a bad policy and detrimental to the proper maintenance of the buildings. A few buildings or roads more or less make little difference in an Executive Engineer's work, and it would usually be sounder administration frankly to give a local body a grant towards their public works and establishment and leave government buildings in charge of the government engineer.

(12). If economy is to be the goal, then the district engineer as such should be abolished, and all work done under the expert supervision of the Public Works Department, who would be responsible to government for funds spent on government works, and to the local body for district funds expended on local works, government as at present levying a percentage on work done to cover the supervision charges. If this were done suitable district board employees could be absorbed in the temporary establishment of the Public Works Department and thus no hardship would be inflicted on deserving men.

(13). Concurrently a good deal of the ordinary repairs such as white-washing and painting could be done by the body occupying a building, as is now done by the Forest Department with forest buildings, Police in the case of all police buildings, and the Jail authorities using convict labour in jails.

(14). The alternative which has been consistently advocated by many, on the plea of advancing local self-government, is to hand over practically all government work to local bodies, with increased grants and correspondingly reducing the government agency.

(15). Tentative efforts in this direction have, however, hitherto not been encouraging and sooner or later buildings, and still more roads thus handed over have been neglected, and we have had to step in to remedy matters.

(16). This is only the natural result of inefficient supervision, and while possibly enabling a local body to shew a small establishment percentage is certainly no true economy.

(17). To give any such system a real chance of success, the class of district engineer would have to be considerably improved. At present, when any difficulty arises, he turns to the nearest Public Works Department officer for help, but with a reduced government agency, opportunities for such help would be very considerably limited with a much extended need.

(18). To secure a better class of district engineer a separate district cadre has been advocated, whereby men would start life in the unimportant districts, and gradually be promoted to better districts with improved pay as they showed their worth. Seniority would usually, however, be the controlling factor in getting promotion, while the whole system being State guaranteed would merely be introducing State control in another form, with the disadvantage that the young engineer would from the start be left to make his way almost entirely without expert guidance. Transfers from district to district in the exigencies of the service or in order to arrange for leave vacancies, etc., would be resented by a local body which had got hold of a good man. Besides, it takes time for a man to become acquainted with the potentialities and needs of a district, and a transfer, just when he had thoroughly grasped the possibilities of his district, while beneficial to the man himself, would not be to the district's advantage.

(19). To advance in the direction indicated two things are necessary:—

(a). First and chiefly, less apathy on the part of the local bodies and the elimination of that tendency towards the actual subordination of the general welfare to individual profit commented on by His Honour in his last review of municipal administration, with sufficient

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singleness of purpose, as a body, to support their own officers in the exercise of their executive powers. My own very limited experience as an *ex-officio* member of a district board, is that unless a member's own interests are touched, the board does little more than confirm the official president's decision. While such a spirit prevails, local government is little better than a farce, and a district engineer cannot hope to get much more into touch with the needs of the district than the present Public Works Department staff.

(b). The second desideratum is a sufficiently qualified body of engineers keen to get district appointments, from whom a selection could be made when a vacancy occurred. The best men would, with public spirited boards, get the best districts as they fell vacant, while junior men, in more poorly paid appointments, would have a strong incentive, in the hope of getting one of the better appointments, to put their best foot foremost. With but few exceptions, the present class of district engineer is, however, not what is wanted, but under present circumstances it is very doubtful whether self-respecting, keen, professional men would come forward for appointments. Concurrently with any such scheme it would probably be necessary to have government Inspectors to periodically inspect the government buildings in a district and see that they were not being neglected.

(20). We might procure a number of men to make a start in a system such as I have outlined, by giving college graduates a training as engineers in an engineering college, and then giving them their practical training as temporary engineers in the Public Works Department, till they showed themselves fit to stand on their own feet, and take over independent charge of a district, when we would give them district appointments, after which their future would rest with themselves. Men found unsuitable for such work should only be retained in the Public Works Department under very exceptional circumstances. The temporary engineer would then understand that he really was only temporary in the Department, and that his future entirely depended on his own efforts.

(21). Before we can usefully do our part however the public spirited district board member, able to advise on the administration of a district, and willing to sacrifice some time for the weal of his constituents must be found in greater numbers than at present.

(22). To have the spending of government money is poor training in local self-government. If the grants are given in a lump sum to be distributed up at the discretion of the members, existing buildings, erected from government funds, such as *dāk* bungalows, rest-houses, as well as cemeteries, etc., in which few members are interested, will be neglected in favour of new works, while if a specified sum is allotted for expenditure on each building any question of local self-government does not seem to arise.

(23). The scandalous way in which many sanitary installations are at present mismanaged by local bodies, is in this respect pertinent. If a community will not look after its own water-supply or guard its homes from the danger of disease from foul smelling drains it is certainly not going to worry about the state of other people's property.

(24). To efficiently manned districts not only could we hand over provincial buildings and roads for maintenance, but the Government of India, as represented by the Archaeological and Army Departments, would doubtless be prepared to reconsider their present attitude towards handing over protected monuments and encamping grounds, etc., to local bodies for maintenance.

(25). The larger municipalities maintain their own engineers—some of them able and highly paid men—but such find ample employment within their own municipal limits and do not clash with the government agency.

4,687. (III.) Changes in organization.—Having thus seen that no change can well be suggested either on the ground of suitability or economy it remains to see whether anything in the existing order of affairs requires attention.

(1). *Superior executive staff.*—Although outside Lahore the time is not yet ripe to have Public Works Department

architects and engineers working side by side in a district, still undoubtedly architects should be recruited to take executive charge of mainly building divisions. The Architect in such cases would be his own quantity surveyor accepting responsibility for rates and estimates, and carrying out all the duties of an Executive Engineer. Thus in Lahore there might be an Executive Engineer in charge of the engineering work, while an executive Architect had charge of the building, instead of having two Executive Engineers as at present. Much building work would still, however, have to be carried out by the engineers in charge of divisions where engineering problems predominated, and while possibly a few of the men, as now recruited, have had training in an architect's office before joining the Public Works Department, the large majority have had their training on purely engineering works. On first joining the Department every engineer might with advantage have two years' training in the Consulting Architect's office, until purely architectural divisions are formed where he can usefully put in part of his time as an Assistant. Similarly, every young Architect would benefit in an engineering division learning the rudiments of road work, etc.

The present system of a Consulting Architect preparing elaborate plans and then letting engineers work out the details of the steel-work, etc., and estimate the cost, is not always satisfactory, especially when it comes to stretching a twelve-inch moulding to hide a fifteen-inch joist, and thereby throwing the whole detail out of proportion; while with a keen Architect responsible for elaboration, one finds the growth of a scheme sometimes accompanied with suggestions for modifications which result in excesses on the original estimate.

The architect is comparatively a new-comer and consequently has a good deal to learn from the engineer, with many years' experience of the country at his back. His advent, however, is decidedly a forward step, and shows that government is prepared to devote money to the aesthetic as a handmaid of education, instead of grudgingly giving a few additional rupees to adorn the severely plain type of building with which engineers have hitherto been compelled to content themselves.

Architects will, however, have just as uphill a task as engineers to establish themselves in private practice, while so many look upon both as superfluities, on whom money should not be wasted, as long as a *mistri* can be found to form bricks and mortar into a fairly satisfactory building for a nominal fee—the ultimate cost being often the last thing considered.

We have now got architectural, sanitary and electric experts to whom we can refer for guidance when necessary, but we still require a responsible mechanical engineer to periodically examine our steam plant, and advise us on the care of our steam rollers, etc., as well as arrange for all necessary repairs, and suggest ways in which we can economically make an extended use of machinery.

It is very essential, however, that all should be under one administrative head able to co-ordinate the work, and having sufficient technical knowledge to weigh evidence, and give an independent judgment, if necessary, in case of conflicting opinions amongst the various branches of the Department.

(2). *The subordinate establishment*—is generally satisfactory, but some really good men lose all heart in their work from hope deferred. Seniority is almost the invariable rule in granting promotion, till eventually these men begin to think that unless they do something markedly bad their promotion will not be stopped, and come to the conclusion that to do as little as possible for the love of the work is life's truest philosophy.

The result is inaccurate work, which when put to the test, fails and brings discredit on the Department. I doubt whether any other branch of the administration ignores the claims of deserving subordinates as ours are ignored. On the other hand, outsiders, when considering their ample opportunity, are only too apt to accuse all indiscriminately of venality.

Draftsmen—are generally satisfactory so far as actual drawing and estimating of quantities are concerned though few are such skilled computers that an Executive

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Engineer can accept their figures without careful checking. Many are, however, lacking in method, and much work has to be done and redone owing to the hopeless way in which drawings are often recorded.

The proper recording of plans is a matter deserving the closest attention, and all draughtsmen should receive a careful course of training in this respect.

A superior class of man, possibly a science graduate with special training, or an upper subordinate, with an aptitude for mathematics, is required in circle offices to check work submitted by divisions, especially the more abstruse calculations, and thereby set Superintending Engineers free to work out the main lines of a large scheme, or scrutinize proposals in hand with an Executive Engineer in their initial stages.

The circle office would then be the final office for the scrutiny of details of all projects, and thereby set the Secretariat free to devote more time to the administrative side of the Department, with more frequent inspections by the Chief Engineer, which would have a beneficial effect on the Department as a whole.

(3). *The clerical staff*—is often inferior and we certainly require a better class of man for divisional head clerkships. Here again the regard paid to seniority is detrimental, and many a smart young man has either left the Department to better his prospects elsewhere or else has become a drudge and lost all interest in anything beyond his daily task, by being kept too long in a junior position, while incompetent seniors have been placed at the head of divisions. An efficient head clerk can relieve an Executive Engineer of much routine work, while with an incompetent man, an Executive Engineer has only too often to neglect his professional work, and devote an unduly large proportion of his time to routine clerical work.

Our system of record keeping requires thorough overhaul. An untrained clerk is pitchforked into a record room there to evolve his own system of keeping records. This usually results in his permanently filing every scrap of paper, and trying to crowd as much as possible into each file, with the result that when a file is sent out to another department for reference, half-a-dozen letters relating to cognate subjects in the same file may be held up pending the receipt back of the original file. The whole system of maintaining records seems to me to want overhaul, and record keepers should receive proper training for their work.

4,688. (IV.) *Relations with other departments and sub-branches*.—Relations with other departments as well as within the Department itself are as a rule cordial, though occasionally diverse minds meet and fail to pull together. There is usually more than one satisfactory solution of a problem, and so long as men can modify their keenness with a sweet reasonableness all goes well.

4,689. (V.) *Decentralization*.—This largely depends on the *personnel*. With the sub-divisional officers so largely drawn from the subordinate class, any general decentralization below the divisional officer will not be advisable at present. At the same time some latitude should be allowed with senior Assistant Engineers holding a sub-divisional charge.

(2). On the other hand, a Superintending Engineer of thirty years' service points out the absurdity of having to apply to the local Government for a brass seal worth a few annas or for authority to write off the books a lost badge; to sanction an addition to a church costing Rs. 5, or appoint a permanent clerk or subordinate to his circle scale. Decentralization is certainly required here.

(3). Again, while lump sums are placed at the disposal of the Superintending Engineer for expenditure on certain minor works and repairs, nothing whatsoever is entrusted to an Executive Engineer, who has to ask for funds for each separate work and submit at the same time definite proposals for approval.

(4). The major portion of the circle grant should be distributed between the various divisions early in the

financial year, to be spent at the discretion of the Executive Engineer.

(5). Any Executive Engineer in charge of a division is competent to sanction estimates for works up to Rs. 5,000 in the case of district boards of the second-class, but can only sanction estimates up to Rs. 500 where the cost is debitable to provincial funds. There seems to be no reason why an Executive Engineer's powers should be more restricted when dealing with provincial funds than with local funds.

4,690. (VI.) *Simplification of procedure*.—One of our Superintending Engineers has summarized the general opinion that the Public Works Department Code and the Accountant-General are the two bugbears of the Department, and give more worry and work than everything else put together.

(2). Since the amalgamation of the Public Works Department with the civil accounts, the Code rules have been largely superseded by a series of circulars issued by the Accountant-General, and the revision of the Code, with its numerous Standing Orders, coupled with considerable simplification and better indexing, is a crying necessity.

(3). As regards the accounts proper, every division is supplied with a trained accountant, who prepares all accounts for the audit office, but the Executive Engineer is required to sign all documents, in token of having accepted an unknown amount of responsibility which I venture to state that 90 per cent. of our Executive Engineers imperfectly understand and none check, signing merely on the strength of their accountant's initials. In some of the forms a single signature is inadequate and two or more signatures are required. Having signed all the originals the Executive Engineer has then got to initial all office copies, in token that he has seen them. The forms, which may run to as many as thirty or forty in a month, while presumably convenient for compiling the accounts of the province, are almost altogether outside the sphere of the Executive Engineer, who is only concerned with his actual works expenditure and stock balance.

(4). Under the rules in force, an Executive Engineer may have to sign a bill, in token of his acceptance, higher up on the same page initial an order to his accountant to draw out the cheque, and finally initial a certificate on the same page that he has made the payment. Should he omit one lot of initials, he will probably have the bill returned by the audit office to make good the deficiency.

(5). Again, in the matter of contracts, the number of initials required on the standard form is colossal.

(6). Such matters may seem trifling, but it all means waste of time, and serves no useful purpose. The Executive Engineer sees the state of his expenditure on a work, a couple of days after signing the accounts, in his Register of Works (which he has again to initial opposite each entry, as well as to initial the works abstract for each individual work). The divisional accountant is directly under the Accountant-General as regards pay and promotion and, accordingly, the accounts could well be submitted to the audit office under his immediate signature while the Executive Engineer's signature accepting a bill should be sufficient authority for drawing out a cheque, and the tender forms could readily be revised so that a single signature with one or two initials would complete the document. Similarly, an accountant should be authorised to dispose of the monthly audit notes, which are frequently made up of a number of very trivial objections, under his own signature.

4,691. (VII.) *Education*.—The only college with the students of which I have come in contact is Roorkee, and one sometimes wonders, when so many of the students will have to devote so much of their time to buildings, that a fuller architectural training has not been given. I am told, however, that this has been recently remedied.

MR. W. S. DORMAN called and examined.

4,692. (*President*.) The witness stated that he was an Executive Engineer of the Public Works Department

with 16 years' service in India, the whole of which had been spent in the Buildings and Roads Branch.

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4,693. It was almost invariably the practice for the construction of large works to call for tenders for the whole work by the insertion of advertisements in the newspapers. In the case of small works, notices were circulated to the principal offices at the headquarters of the district, i.e., the offices of the Deputy Commissioner, the district board and the municipality, in addition to being posted up in the offices of the Executive Engineer and the sub-divisional officer concerned, while if the construction of a particular work had to be expedited and time did not permit of wider advertisement notices were simply sent to selected contractors.

4,694. All original government works and practically all repairs were at present executed by contract, except the maintenance of roads for which it was necessary to employ departmental labour. The system of road maintenance by contract had been tried in the past and failed, but he could not give details as the experiment had been tried before his time and he had heard about it from senior officers of the Department.

4,695. Private enterprise was freely encouraged at present, especially in connection with the construction of steel bridges and roof trusses, etc. An Executive Engineer sometimes prepared his own design for a bridge and forwarded it to the firms which were asked to tender for its construction. He had, however, not recently been connected with this class of work. He had prepared all his own designs for the trusses of various buildings in Lahore and subsequently asked firms in Bombay, Calcutta, etc., to tender for them, specifying the conditions of loading and at the same time informing the firms that while preferring his own designs he was prepared to consider alternative proposals of equal strength to suit the sections they had in stock. He added that when designs were prepared by the Department for this class of work it was usually left open to the firms tendering for the work to suggest alterations.

4,696. He had not had sufficient experience to express an opinion as to whether there was sufficient bridge work in the province to justify the appointment of a specialist in bridge construction.

4,697. The King Edward Memorial which he had constructed consisted of a group of buildings which included the Medical College and hospitals in Lahore. Tenders had not been invited for the construction of the whole project as it would not have been possible to put all the buildings in hand simultaneously. No large firm had offered to undertake the construction of the whole project, but he had advertised in the newspapers and accepted the best tenders that were submitted. The establishment charges in connection with the construction of the Memorial had amounted to only 5½ per cent. on the actual cost of construction, and the only European contractor who tendered had asked for a 30 per cent. increase on the estimated rates. By distributing the work amongst a number of local contractors, each of whom received a contract of from Rs. 2 to 3 lakhs downwards, the work had been actually constructed at 3 to 5 per cent. below the estimated rates of the Department. The figure of 5½ per cent. for supervision had been taken from the provincial administration report and included all the divisional establishment engaged on the supervision of the work, including the divisional accounts staff. It did not, however, include direction charges, or the cost of tools and plant, engines or cranes which had been negligible.

4,698. District engineers were employed side by side with government engineers, and the system involved a certain amount of overlapping. The most efficient method for the construction of district works would therefore be to entrust all such works to the staff of the Public Works Department, and to entirely abolish the staff of the district board. His recommendation was based solely with reference to economy and efficiency of construction and had no relation to the broader issues of local self-government, or to the encouragement of private enterprise. He was opposed to the alternative method under which district boards would take over the construction and maintenance of all government buildings within their jurisdiction, on the ground that

such bodies were not sufficiently advanced to be entrusted with such responsibility. The only district of which he had had much experience was Kangra. He was an *ex-officio* member of the board of that district and attended all the meetings he could. The board had no public works committee, but he was always prepared to give professional advice on the construction of district public works whenever required. Very little discussion, as a rule, took place at meetings of the board in connection with the construction of district works. After the programme of works and the allotment of funds had been fixed, he gave professional advice only if anything transpired in the discussion which seemed to him to call for his remarks, but as a rule nothing of this nature occurred. The Executive Engineer had formerly to inspect all district board works of which the plans had been submitted to him for approval, but this practice was no longer in force. He admitted that, as a member of the board, he had authority to see whether the construction of a particular work was being carried out efficiently, but, while he occasionally examined district works in progress and informed the district engineer if he noticed anything wrong, he did not make regular inspections which would probably only have resulted in friction with the district engineer. Since the rescission of the rule to which he had just referred, he felt he was no longer required to inspect regularly district buildings and roads. He did not consider that he had been appointed a member of the board for purposes of inspection, as the plans of all important district board works were supposed to be submitted to the Executive or Superintending Engineer, whether that officer was a member of the board or not. He felt that the object of his appointment was that if the board required his advice on any question, he could give it to them. He had not looked at the matter in the light of his having any special initiative in respect to district board works though he made suggestions from time to time.

4,699. Architects should be placed in executive charge of purely buildings divisions instead of engineers as at present, but he had not studied the question sufficiently to say whether such Architects might be subordinate only to a Consulting Architect; but he considered that the system he had advocated would be more satisfactory than that at present in vogue.

4,700. Seniority instead of election was almost invariably the rule in granting promotion to the subordinate establishment. He was unable to state the percentage of senior upper subordinates who had not been given sub-divisional charges on account of their inefficiency, but was aware that such cases had occurred though such men were sometimes given sub-divisional charges because better men were not available. Hence he advocated the stricter selection of subordinates from an early stage in their service and that promotion should be regulated by merit to a much greater extent than was the case at present.

4,701. Officers in the superior service were recruited on the understanding that, provided they gave satisfaction, they would be promoted to executive rank within a certain number of years. He considered however that candidates for the service should only be assured the prospects of Assistant Engineers, and that their promotion to executive rank should depend entirely on their giving satisfaction. He anticipated the system he had proposed would not affect recruitment, but added that he had not considered the point carefully; it concerned all branches of the Public Works Department and had been gone into by the Public Service Commission. Seniority had been the main factor in connection with the promotion of officers to executive rank in the Punjab.

4,702. Executive Engineers in the province had ordinarily powers of technical sanction in the case of original works and special repairs up to Rs. 500, the powers of selected officers being Rs. 1,000. In the case of tools and plant their powers were Rs. 200 and Rs. 500, respectively, and these limits applied to all (imperial, civil and military, provincial and contribution) works. The Superintending Engineers had powers of sanction up to Rs. 10,000 for communications and buildings and

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Rs. 2,000 for the purchase of tools and plant. He was not aware why the powers of Executive Engineers in the province had been so restricted, but recommended that, as such officers could approve estimates up to Rs. 5,000 in the case of district works, their powers of technical sanction for imperial, provincial and contribution works should be increased to Rs. 5,000 in the case of selected officers and Rs. 2,500 in the case of other officers.

4,703. It would not be safe to entrust sub-divisional officers with powers of technical sanction, as a matter of course, but senior Assistant Engineers or selected sub-engineers could advantageously be entrusted with some powers of technical sanction. The delegation of such powers would obviate the necessity for the submission for sanction by those officers of a number of petty estimates, and would afford a certain amount of relief to Executive Engineers.

4,704. He could not say definitely how much of the Executive Engineer's time was spent on the actual signing of accounts and admitted that he himself as often as not simply signed his accounts on his accountant's assurance that they were in order. An Executive Engineer was theoretically not supposed to sign his accounts until he had made a thorough examination of all the books and documents connected therewith, but he himself had not followed this procedure as he had not the time for the purpose. He added, however, that he scrutinized certain forms and looked for certain points in signing his accounts but that he signed the large majority without examining them. He was emphatically of opinion that a very large proportion of the accounts work of Executive Engineers, as embodied in the forms submitted each month to the Accountant-General, was useless from the executive point of view, and that all that a divisional officer required in order to keep himself fully acquainted with the progress on his works and the expenditure could be secured by a simpler system of accounts than that at present in vogue.

4,705. The particular records which he, as an Executive Engineer, desired to retain purely for executive purposes were the cash book, stock account, a simplified form of works abstract and the register of works. The register showed the total up-to-date expenditure by sub-heads, and hence any excess on a particular work could immediately be traced. The method of keeping accounts by sub-heads was useful as well as necessary, as it indicated possible excesses over estimates. It was rarely possible to foresee excesses when giving out a contract by a reference to the rates in the estimate. Excesses were usually due to something unforeseen cropping up in the subsequent execution of the work, or sometimes to insufficient provision having been made in the estimate itself for certain classes of work. If no departure took place from an estimate there was very unlikely to be any excess. Sub-heads were kept for major works, but not for minor works, i.e., those which cost less than Rs. 5,000. In his opinion the maintenance of sub-heads for all works over Rs. 5,000 afforded a useful check, but practically all the forms signed by the Executive Engineer about the 20th of each month could be abolished as they served no useful purpose from the executive point of view.

4,706. As an Executive Engineer he was supplied with a list of works to be constructed during the year, together with a separate allotment of funds for each work. This did not, however, hamper him. Were an Executive Engineer given a lump sum for all the works in his list, he might be able to expedite the construction of some works more than others, and he did not think that such a system would result in building unduly in accordance with convenience and facility of construction instead of with the exigencies of requirements, as he considered officers could be trusted to do their best in the matter.

4,707. (Sir Noel Kershaw.) The statement in his written evidence "could a private firm be found to take up our general construction and maintenance work, it would probably reckon on 20 to 25 per cent. to cover its establishment, plant and margin of profit," referred chiefly to maintenance work. "The various schemes of the Department which never fructified but which were propounded for the amusement of the Department" would

be much reduced in number if such schemes had to be paid for.

4,708. With reference to the remark in his written statement to the effect that "a private firm would naturally have its own interests at heart, and the tendency would be to encourage extravagancies, with a view to increasing the outlay and thereby augmenting its own earnings", he stated that if such a firm desired re-employment at some future date it would be very careful in connection with lavish outlay, and that he would not as a matter of fact re-employ a firm if he were convinced that it was deliberately extravagant. At the same time there would be the inevitable tendency to encourage the use of more expensive material and a higher class finish for the sake of appearance and the firm's reputation when cheaper materials and a plain finish would answer equally well, and it was this that he had in mind when writing.

4,709. He did not think that it would have affected him if he had been informed when he was recruited, that his promotion to executive rank, after 5 years' service as an Assistant Engineer, would not be governed by seniority but by merit.

4,710. (Mr. Mackenzie.) A good Executive Engineer was capable of forming an opinion regarding the construction of a building costing Rs. 50,000 quite as well as any other officer.

4,711. If the Deputy Commissioner, who was the chairman of the Kangra District Board, desired him to express an opinion on any matter or to inspect a building that officer would undoubtedly ask him to do so, but he could not say whether that officer might not have taken offence if he had conducted inspection work without first having been requested to do so. The district engineer of Kangra had received no theoretical training, but he possessed a fair practical knowledge.

4,712. (Rai Bahadur Ganga Ram.) It would be of advantage if buildings designed by architects were also constructed by those officers though Executive Engineers could undoubtedly properly interpret architects' designs. He desired to create an architectural service which would form an integral part of the Public Works Department, i.e., he would recruit Architects in exactly the same manner in which Assistant Engineers were at present recruited and he thought the system he advocated would prove economical.

4,713. Officers should be promoted to executive rank by selection. He preferred not to express an opinion on the question whether the pensionary system should be abolished and substituted by a provident fund, and whether an officer should be allowed the right to leave the service after repayment to him of his subscriptions to the provident fund at any time he so desired, government having the right likewise to require him to quit the service at its convenience.

4,714. He had had some experience of Katni and Bundi cement and had found their quality to be satisfactory. He had no suggestion to make in regard to the storage of these brands of cement in bags, and mentioned that he understood bags were freely used for the purpose in England and America.

4,715. (Mr. Cobb.) District board works were, he believed, practically entirely in the hands of the Deputy Commissioner and it was most desirable that members should evince a greater interest in the work of their boards.

4,716. An estimate had been framed for the construction of the King Edward Memorial scheme and the cost of construction had worked out very much on the lines estimated. There had, however, been a fairly large number of additions and alterations to the buildings, and such were covered by a provision of 5 per cent. which was as a rule allowed in all estimates for contingencies.

4,717. The promotion of subordinates should be made by merit by the Chief Engineer subject to the recommendations of two or more Executive Engineers.

4,718. Promotions to the rank of Executive Engineer should also be largely regulated by merit and be made by the local Government, subject to the recommenda-

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tions of a committee composed of the Chief Engineer, a Superintending Engineer and a third party, an officer of government, not necessarily an officer of the Public Works Department.

4,719. The cost of the preparation of the various schemes which never fructified should be charged against the department which had called for them.

4,720. (Mr. Aikman.) In a comparison between the establishment charges in India and those in western

countries the rates for Indian labour would be considerably lower. The same was applicable to a large extent to the cost of building materials, e.g., bricks. Hence if a building was constructed for £10,000 in England it would cost less to construct a similar building in India. Supervision would, however, be necessary to the same extent as at present. The percentage on this account would therefore necessarily be considerably higher in India than in England.

BAWA BUDH SINGH, Executive Engineer, Shahpur
Engineers' Association. Provincial Division, Representative of the Punjab

Written Statement.

1,721. (I.) Economy and suitability of methods of execution of public works.—The present system of having the civil works done partly by Public Works Department Buildings and Roads Branch, and partly through the agency of district boards is certainly not very commendable as double establishments have to be kept for similar works in every district. This system is neither conducive to economy nor efficiency.

(2). The method at present adopted by the Punjab Buildings and Roads Branch is quite suitable and economical for the purpose in view. It is, that the Buildings and Roads Branch is responsible for the design and estimate, while the department concerned is responsible for its own requirements and to see if they are suitably provided. The work is actually carried out by private agency—contractors—under the direct supervision of the Buildings and Roads Branch officers. The works thus executed are quite economical, and I can say from personal experience they are more economically executed than any private works of the same nature and quality, and built under similar circumstances.

(3). The general idea that Public Works Department works are not economically executed is quite erroneous; no one has so far come forward to prove this dictum by facts and figures. The assertion of some of the civilian and police officers that works executed under their supervision, viz., the district board works and police repairs, are done cheaper than the Public Works Department works cannot stand the lime-light of scrutiny for a minute. The quality of such works is generally quite inferior to that of the Public Works Department works, and again in some cases free and under paid labour and materials seem to have played a prominent part in their execution, while the Public Works Department have to pay full market rates for the work done.

4,722. (II) Encouragement of other agency.—I think private enterprise under the existing system is not quite sufficiently encouraged. Almost all civil works are, however, executed by private agency, viz., contractors, under departmental supervision. As regards the purchase of material of European manufacture I think the rules may be relaxed a good deal and more powers delegated to executive officers. More firms might with advantage be brought on the Public Works Department list in order to have a healthy competition. Manufactures of well known firms—e.g., Dorman Long's steel joists or Gillingham Brand cement, might be allowed to be purchased from any respectable firm, irrespective of the fact whether it is borne on the Public Works Department list or not. In this respect I would like to suggest that every local Government may have a central stores bureau, which should help the executive officers in making purchases of materials of European manufacture. The executive officers should send their requisitions to the bureau, and make no direct purchases except under exceptional circumstances. I think it would be really useful if such a bureau, as suggested above, could also undertake the manufacture and storage of standard sizes of doors and windows and other departmental requirements. Manufacture of Public Works Department requirements in India should be encouraged, except proper safeguards should be taken to see that the quality of such manufactures does not deteriorate. I think the Government is already much interested in the matter.

(2) Adverting to the possibility of entrusting construction or repairs to other agencies, I have no objection provided strict departmental supervision is maintained. Probably the object of the query is to find out if such works and repairs could be entrusted to local boards or private engineering firms. There would be no harm if local bodies were up to the standard of the English County Councils, but in the Punjab the local bodies are not yet so advanced. The members generally lack keen and intelligent interest in works in most cases, probably because they are absolutely under the influence and control of the district executive officer, viz., the Deputy Commissioner. No doubt every district board employs a district engineer who looks after the district board's works, but the Deputy Commissioner is practically the final authority in the case of such works, and he is, after all, a layman to the profession of buildings and roads.

(3). The projects of the district boards are technically scrutinized by the Public Works Department officers, but the actual construction is entirely in the hands of the district board. The Public Works Department superior officers could object to faulty designs and indifferent quality of work done, but such interference generally results in unpleasantness which it is not very desirable to court, especially with the executive head of a district. If civil works were to be transferred from the Buildings and Roads Branch to the district board it will be simply transferring them from one department to another, which is admittedly professionally less competent to undertake such duties than the Public Works Department. I do not recommend this course for the present, as the experience of the Public Works Department officers shows that all the roads and buildings so far transferred to the control of district boards are, with very few exceptions, not so well maintained as those of the Public Works Department. In this connection it may also be appropriately pointed out that transference of civil works and roads to the district boards, before this, has proved an utter failure on more than one occasion.

(4). The chief cause of deterioration of works under the control of district boards is that there is only one professional man to look after them and he is practically responsible to the president, viz., the Deputy Commissioner, a layman. The district engineer has to follow the wishes of the civilian head, who has himself no technical knowledge of the work—thus a district engineer is the sole professional authority for all works under him, while in the case of the Public Works Department a sub-divisional officer, who is directly responsible for the construction of a work, is under the immediate control of an Executive Engineer, and the periodical visits of the higher Public Works Department officers tend to keep the machinery in efficient working order. I might further add that the district engineers have so far been generally drawn from the retired upper subordinate class, civil or military, with a few exceptions, and it is only recently that some district boards have employed young engineers of proper qualifications. In certain cases the posts of district engineer are held by retired officers who have no energy left in them; at any rate the manning of the district board engineer establishment is far inferior to that of the Public Works Department.

(5). From the nature of projects submitted by the district boards, it has been noticed that they are not prepared very carefully and have to be returned again and

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again for amendments and even in their final form they are hardly equal to the Public Works Department work. The quality of work done by district boards is certainly not equal to that of the Public Works Department work. Projects costing above Rs. 2,500 should as a rule be submitted to the Public Works Department for approval, but in the case of road work this rule is followed more in avoidance than adherence. Estimates in small batches are prepared and sanctioned by the Deputy Commissioner to avoid technical objection.

(6). From the above procedure it is evident that district boards after all are to be entrusted with minor works only, and the Public Works Department has still a lot to do for the local bodies, in the way of checking their projects, works, etc. Where is then the necessity for keeping a highly paid district engineer? The Public Works Department sub-divisional officer could do all this as satisfactorily as a district engineer.

(7). The Government in April 1910 transferred all feeder roads in the Punjab to the control of district boards—vide Punjab Government, Public Works Department, Buildings and Roads Branch circular No. 1-B., dated the 28th March 1910—but in doing so government had to supplement the district board funds by substantial grants from provincial revenues. If any more works are so transferred to district boards more grants from provincial revenue will be needed and this point has been clearly hinted at by one of the Commissioners. Thus in handing over works or repairs to district boards there can be no financial economy, as the Public Works Department is still to remain intact for larger works and scrutinizing district board projects and works.

(8). The condition of those government buildings which have been entrusted to district board or departments other than the Public Works Department, for purposes of maintenance, clearly shows that they have not been efficiently maintained. By transferring government works to district boards, we shall be entrusting valuable property to a less efficient agency than the Public Works Department (Buildings and Roads Branch) with all its experience of more than half a century.

(9). Now coming to the second proposal, viz., to transfer all district board works to the Public Works Department. This will, no doubt, mean some increase in the establishment in the subordinate grades, but the increase will be much less than what the district boards spend on their establishments. The objection that outlying works are better attended to by district boards than the Public Works Department is futile. Public Works Department subordinates and officers can as well go to the remote places as the district board ones can. Even now the Public Works Department have to do all original works and special repairs to police buildings, many of which lie in out-of-the-way places. Where a district engineer can go, a Public Works Department sub-divisional officer can also do the same.

(10). I briefly outline the system of work after amalgamation of the two departments. Every district should be in charge of a Public Works Department officer of the grade of an Assistant Engineer or a senior upper subordinate who may be designated a "district engineer." The "district engineer" should be under the orders of the divisional Executive Engineer, but in matters of district board works he should consult the district board concerned. The Executive Engineer to be the immediate superior officer of the district engineer. I would further propose that all municipal works in a district should also be under the charge of the district engineer. First-class municipalities, however, can have their own municipal engineers. No contribution charges to be levied from the district board, the latter should, however, pay a fixed proportion of the total establishment and direction charges to the local Government. This annual contribution to be based on the proportion of expenditure incurred by the two departments respectively and should be unchangeable at least for five years.

(11). If such a scheme as outlined above with any modifications deemed necessary for administrative facilities is followed, much financial economy is sure to accrue. I am certain in a few years the result will

be efficiency all round and the reproaches from the head of the Government that the Punjab roads are bad will become things of the past.

(12). There is another way of abolishing the dual control of civil works in a district, and it is that all government works be transferred to district boards. This could only be acceptable if—

(a) the district engineers were as efficient as government engineers;

(b) a proper system of superintendence of their work was instituted;

(c) undue interference on the part of the civil executive officer of the district in the district engineer's work were minimised;

(d) the district engineers and superior inspecting officers were borne on a separate departmental cadre.

If this could be done, then there is practically no difference, except in name, between the two proposals, viz.—

(i) to transfer all district board works to the Public Works Department;

(ii) to transfer all government works to the district boards.

The proposal No. (i) is certainly more appropriate than No. (ii) at the present day, because the local bodies have not attained any high degree of efficiency and they are nothing better than another department governed by the Deputy Commissioner.

An intermediate proposal—lying between Nos. (i) and (ii)—would be to transfer all repairs and unimportant works to the district boards, while the Public Works Department concentrated its energies on larger works, the district boards to be entrusted with all minor works, etc. This proposal, although apparently reasonable, has the great defect that dual control in a district will still go on as at present, and a large number of government works will pass under less efficient (professional) control. As I have already stated, a district engineer's work is practically not subject to any outside supervision which is really a very great drawback. If some sort of dual control is to be maintained, then I think the best course would be to bring the work of a district engineer professionally under the divisional Executive Engineer. I do not advocate the duplication of the present engineering establishment by having separate divisional engineers for district board work; what I mean is that the present Public Works Department Executive Engineer should also be made responsible for district board works, and the district engineers should be professionally under the Executive Engineers.

(13). Adverting to the question of encouraging private engineering firms, there are two ways of looking at the question:—

Firstly, that engineering firms are to displace the present contractors of indifferent qualifications, while the Department will supervise their work as before. This course is desirable, because we do need a better class of contractors than is at present available.

Secondly, to entrust such firms with the design and execution of the works without any strict supervision on the part of the Department. To be more explicit, in the first case we will require one Public Works Department official with some subordinates to be in charge of the work, while in the second case this contingency will not arise. Only one officer specially deputed for the purpose would pay periodical visits to the work and pass it finally when completed. The detailed supervision of the work at every stage of its construction, e.g., mixing up of ingredients, selection of materials used in the interior of work, etc., will be done away with.

I do not think the second course can at present be adopted with advantage. In India we have very few firms of the high standard required which could be trusted with such responsible duties. The resources of large cities like Calcutta and Bombay are an exception. Again, such large firms can hardly prove economical in the execution of *mofussil* works and repairs. No doubt encouragement of private firms is desirable, but this should not be at the expense of quality of work. Some experiments in this direction may be carried out in large cities.

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(14). The best way to make a start would be that the large municipal committees should make a rule that construction and design of all large private works (say above Rs. 20,000) within municipal limits should be carried out under the supervision of properly qualified engineers. This will give an impetus to private practice in engineering. In short, my recommendations are that changes in the following directions may at present be experimentally carried out:—

(1). Large municipal committees should entrust their large works to engineering firms of standing. This will cause a good deal of economy, as the necessity for their keeping expensive municipal engineers will be obviated, and ordinary works—original and repairs—could well be supervised by less expensive engineering staff than at present maintained.

(2). The district board works should be transferred to the Public Works Department and dual control of works in a district abolished.

4,723. (III.) Changes in organization.—If my proposal to amalgamate district board works with the Public Works Department be accepted, then the following modifications of the organization of the staff of the Public Works Department will be needed:—

(1). Cadre of Assistant Engineers should be increased, so that all district charges be held by engineers so far as practicable.

(2). No one below the rank of a sub-engineer should be given charge of a district.

(3). Two or more districts, according to the amount of work, should form a division.

(4). Separate divisions or sub-divisions may, when necessary, be maintained solely for large and very important government works, e.g., works at the headquarters of the local Government, or works like the King Edward Memorial Hospital.

(5). Special sub-divisional charges carrying with them an Assistant Engineer's travelling allowance and Rs. 50 as sub-divisional allowance should be abolished. It is an anomaly to see junior men holding such charges merely by chance, while senior men are not favoured with this privilege. The privilege of higher allowances, if it is to be retained, should go with the person duly qualified to enjoy it and not with the charge which could be held by an overseer or a junior supervisor, if chance favours him. I think this privilege should be abolished altogether and those persons who are considered fit for advancement should be given Assistant Engineer's rank. At present a higher rate of travelling allowance is simply wasted on those who can hardly be expected to live up to the standard expected from a first-class officer.

(6). At present promotions to the engineer establishment are made generally from the senior sub-engineers. Such promotions are not desirable, because:—

(i). The promoted upper subordinates having spent the best part of their service in the subordinate line and being close to retirement, can hardly be expected to adapt their mode of life and habits to suit the officer grade.

(ii). Very little energy is left in a person after 25 years' service, to be really useful in the superior grade of service.

(iii). Such promotions are generally a pecuniary loss to the persons promoted.

(iv). These upper subordinates generally do not possess technical knowledge and knowledge of English of that high standard which is expected from Assistant Engineers.

I propose that candidates for promotion to the superior establishment should be selected between the 10th and 15th year of their service. Such candidates should be required to pass a departmental examination.

Selection should be very strict and special regard should be paid to the educational qualifications and the qualities required in an officer; and recommendations for such promotions should not be solely based on the work done by the subordinates in a sub-division.

In the ordinary course of the routine, a sub-divisional officer is expected to do very little designing or work requiring a high degree of technical knowledge; and therefore some upper subordinates may run sub-divisions

satisfactorily, but in the superior establishment they are expected to tackle problems of engineering requiring a broad knowledge of science and mathematics. It has been noticed that most of the upper subordinates promoted to the superior establishment have no higher educational qualifications than the matriculation or middle school examinations. To promote such poorly educated persons to the superior establishment is simply degrading the superior service.

The case of those upper subordinates who had qualified for the Assistant Engineer grade in their college examinations, but accepted subordinate service, because they could not get permanent jobs in the engineer service, stands on a different footing. Such persons should always be preferred to those who qualified as upper subordinates.

4,724. (IV.) Relations with other departments and sub-branches.—The Public Works Department has so far successfully met the needs of other departments, but lately a desire to control most of the government works in a district has been manifested by some civil district officers. These officers want to have the government civil works under their own control, through the agency of district boards. Their difficulties seem to be two fold. First they cannot get things done promptly, because the departmental rules of getting rough and fair estimates sanctioned, and allotments provided before any work is executed, generally make some district officers very impatient. They want a thing done when ordered. Secondly, they cannot have always their own way in the matter of additions and alterations. If the works were in charge of the district boards the restrictions of the Public Works Department would disappear and funds would become more elastic.

(2). The present relations between the sanitary, architectural and civil engineering branches of the Public Works Department seem satisfactory. The Electrical Department should be directly under the Chief Engineer.

(3). I think all sanitary projects should be prepared in the Sanitary Engineer's office, and all surveys, etc., for such projects should also be made under that officer's direct control. The Sanitary Engineer in the Punjab may have two Assistants instead of one. This department should take a more active part in actual construction than at present, and should not act as a mere critic.

4,725. (V.) Decentralization.—More powers than specified in the Public Works Department Code, Volume I, paragraphs 294 to 329, should be given to Executive Engineers as they are the officers on the spot to carry on large works and small and meet the demands of local departmental officers. The present system is very circuitous. Every demand of over Rs. 200 has first to go up in rough to the departmental head—*vide* Public Works Department Code, Volume I, paragraph 648 (iv)—then after his sanction a fair estimate has to go up for technical sanction and provision of funds. All this takes up a very long time, not less than two or three months, and could be avoided.

(2). Executive Engineer's powers may be increased in the following directions:—

(i) All funds for repairs and original works, which an Executive Engineer is competent to sanction, should at once be placed at his disposal, as soon as a budget is out. The present powers are merely in name, but in fact every estimate for original works and special repairs and the estimated amount of all stereotyped annual repairs estimates have to go up to the Superintending Engineer, who as a general practice places funds at the Executive Engineer's disposal to sanction such estimates.

(ii) Powers for local purchase of materials of European manufacture should be enhanced to Rs. 1,000. This will be advantageous as the Executive Engineer could place his orders, after determination of the lowest prices. Market prices change daily now-a-days and in normal times also these prices fluctuate considerably.

(iii) Powers to sanction survey reports, tools and plant, and stock may be extended to Executive Engineers. Amount to be fixed at Rs. 500.

(iv) Leave.—Executive Engineers may be granted powers to grant privilege leave to their clerical, drawing and menial establishments, as well as lower subordinates of

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their divisions; also to appoint their substitutes subject to the rules of the Civil Service Regulations and Public Works Department Code.

(v) *Appointments, promotions, transfers, punishments and dismissal.*—Full powers as mentioned in paragraph 329 (j), (k), (m), (n) and (o) to be exercised by Executive Engineers without interference. These powers are, I believe, fully or partly being exercised by our brother officers in the Irrigation Department.

(vi) Unforeseen items, not provided for in the estimate, may be executed under orders of the Executive Engineer and at rates settled by him, if the estimate is not exceeded beyond the permissible limit and the cost of each such item is not above Rs. 500. Any large items or omissions, etc., should form, as heretofore, the subject of a revised estimate. Deviation statements subject to the condition that they do not involve expenditure over Rs. 500 and that the estimate is not increased beyond the permissible limit, may be sanctioned by Executive Engineers. Such deviation statements, similar to the reappropriation forms, should always be duly sanctioned and filed, so far as practicable, before any extra work is done.

(vii) Annual leases of government lands, etc., by public auction should be given out by Executive Engineers, subject to approval by the Superintending Engineer of leases whose annual value is above Rs. 500 and those which have been leased for more than three years.

4,726. (VI.) *Simplification of procedure.*—The Public Works Department Code provisions are generally adequate, but the following changes are needed:—

Paragraph 816 may be changed so as to eliminate the necessity of obtaining a completion certificate. In this connection it may be urged that the completion certificates required under Public Works Department Code, Volume I, paragraph 825, as amended by Standing Order No. 210, and 816, as amended by Standing Order No. 211, should be done away with. These certificates are the cause of a great deal of friction between the Public Works Department and other departments. The officers signing the completion certificate generally go beyond their limits in asking for the estimates and plans and checking items of work with it. This is simply annoying. The departmental officers often ask for works not entered in the estimate and officials of other departments often worry the Public Works Department contractors and subordinates, with the threat of not signing the completion certificates. The Indian officers experience greater difficulty in this respect than the Europeans. When a responsible officer of the Public Works Department of the standing of an Executive Engineer signs a completion certificate the necessity for its countersignature by an officer of the department for whom work is done should not arise. If the departmental officer for whom a work is executed has any objection as to its proper completion, he should refer the matter to the Executive Engineer or Superintending Engineer. A lot of delays occur in the preparation of completion reports as the departmental officers will not sign these completion certificates for several months. All these troubles could be avoided if the signing of completion certificates by the department for which a building was constructed was done away with.

(2). Procedure of getting a work executed be simplified in such a way as to assure prompt execution of minor works, when required by departmental officers.

(3). In the case of works for which allotments or sanctioned estimates are received too late to admit of any expenditure being incurred thereon before the end of the financial year and funds have to be surrendered or allowed to lapse in consequence, it is a great drawback at present to keep waiting for a fresh allotment before the works can be started next year and it would be a great relief to amend Code, Volume I, paragraph 781, to allow such works being commenced during the next year without waiting for the fresh allotment of funds. This will greatly facilitate prompt execution of works for other departments.

4,727. (VII.) *Education.*—In the case of the education of young men for the profession of civil engineering, I think a change is needed. The engineering profession should be on the imperial basis and not provincial. There should

be one well-equipped government college for civil engineers under the control of the Government of India. I think the Roorkee Engineering college is well suited for the purpose. This college has been declared to be up to the standard of the best similar institutions in England and Europe. There should be only one central college for engineers, while subordinates should as a rule be trained in provincial colleges. The central college should not be burdened with the training of subordinates.

(2). In order to facilitate prolonged practical training, I think the college course should be curtailed. At present it is a three years' course and before 1898 there used to be a two years' course only. I would propose a two years' course at college and a two years' course for practical training. The college course can easily be reduced without effecting the efficiency of instruction imparted in the college. At present a lot of time is wasted in teaching mathematics and the elements of physical science and chemistry. I think all these subjects can well be mastered in the university colleges before joining the engineering college.

(3). It must be made a condition of entrance to the college that every student before entrance must have passed the Bachelor Degree examination of some recognized university, having qualified in pure and applied mathematics, and that the students must have passed in physical science in their intermediate examinations. The Indian students admitted to the college are all graduates now, while Anglo-Indian and other non-Indians are not so. For them the school final examination is considered sufficient—vide rule 7 of rules for admission to the engineer class of the Thomson Civil Engineering College, Roorkee. If the standard for admission to the college were equalized, both for the Indian, Anglo-Indian and non-Indian students, I think a lot of time spent in teaching mathematics and science could be usefully saved.

(4). During the college sessions I think engineers of reputation should be invited to deliver lectures to the students on practical engineering. Experts from all branches of engineering, viz., railways, irrigation, buildings and roads, sanitary, architectural and electrical, should be so invited. Such lectures will prove more useful than those delivered by professors who seldom have an expert knowledge of actual works.

(5). I consider the system of education in the government engineering colleges in India, especially at the Roorkee College, is organized on a sufficiently broad basis to produce suitable engineers for all services if their college education is supplemented by two years' practical training.

4,728. (VIII.) *Practical training.*—As regards practical training, I think much improvement is needed. The present system is defective. The qualified students do not get sufficient insight into the execution of works, preparation of projects and working of the sub-divisions.

(2). I think out of the two years' practical course recommended by me at least six months should be spent in the Secretariat, Government Architect's and Sanitary Engineer's offices, in acquiring first-hand knowledge of large projects being dealt with in those offices. This will give the qualified student a good and desirable training in the preparation of large projects. The qualified engineer student must undergo training under three Executive Engineers, and at least six months should be spent on a sanitary work and for six months or less he may be trained to run an ordinary sub-divisional office. It would be useful if apprentices were sent on rounds of inspection of important works in execution under the Public Works Department.

(3). I consider the present system of apprenticing two qualified students for each post is not useful; it simply causes friction between the two candidates and the junior man always tries, by all possible means, to hoodwink the senior to get him condemned if possible. In my opinion a requisite number of qualified students from the Roorkee College should be given practical training under different officers and when recommended as fit, irrespective of the grade of fitness, the senior men should be given the permanent jobs.

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(4). The students who have passed out of English colleges and have taken a course of practical training with some well established English firm, should on arrival in India, be given practical training for one year only, in order to get practical knowledge of works under Indian conditions.

(5). I think selected students of the Indian colleges after eight years' service should be sent to foreign countries for specializing in particular branches of civil engineering, viz., railways, sanitary, architectural, buildings and roads, electrical, etc.

BABA BUDH SINGH called and examined.

4,720. (President.) The witness stated that he was an Executive Engineer in the Public Works Department and that he had 14 years' government service; also that he had received his engineering education at Roorkee.

4,730. The view in his written evidence that works were constructed more economically by the Public Works Department than by private agency was based on his personal experience of work in the Department and on that acquired while erecting a house for himself by means of private agency. He had also come to this conclusion by working out details of the comparative cost of the construction of buildings by government and private agency. The difference in cost was due to the fact that contractors employed by government were generally large and continuous employers of labour and hence could command cheap labour, while private individuals were obliged to accept the services of *coolis* from the bazaar for the purposes of daily labour work, with the result that the cost of such work was greater than that of government works. Contractors could also purchase materials at cheaper rates than private individuals. He had not personally supervised the construction of the house he had erected for himself, but had employed an agent to arrange for materials, etc., on his behalf.

4,731. The general complaint regarding the dearness of Public Works Department work was put forward chiefly by district board and police officers, and he surmised that if a comparison of the work carried out by these officers were made with that of the Public Works Department it would show that its quality fell far below the standard of the Public Works Department. An instance of the erection of a police station by the Police Department at a substantially less amount than the Public Works Department estimate was here put to him. He admitted its possibility, but added that if an examination of the accounts and methods of execution of works constructed by sub-inspectors and inspectors of police were made, it would show that the reduced rates at which such works were generally executed were the result of the impressment of a certain amount of free labour and materials by those officers. Not only the police, but officers of other departments also, abused their official influence in order to obtain materials at rates below the market rates. In this connection, he cited the case of a rest house that had been erected by a certain district board through its *tehsildar* at a lower cost than that incurred on the construction of a similar work by the Public Works Department, and mentioned that as the *tehsildar* in question had great control over the people in the *tehsil* he had been supplied with bricks, at a very much lower rate than the market rate, by a contractor in order not to be prohibited from burning bricks by the *tehsildar*. Land for brick-burning in colonies was leased out by government or municipal committees. He added that a mason, whose ordinary charge was Rs. 1-8-0 per diem would probably accept only 14 annas from a *tehsildar*. It was not the case that such officers were ordinarily more successful than the Public Works Department in securing cheaper rates for work, but rather that they possessed more power in the localities concerned than the latter possessed. In effect, their methods of carrying out works in the Punjab were to some extent a survival of the system of forced labour.

4,732. The present rules regarding the local purchase of stores should be revised and the powers of Executive Engineers should not be restricted to purchases only from recognised firms when articles of the same quality were procurable elsewhere. He did not desire that the rules in

(6). Those qualified students who want to take a course of practical training on their own accord on government works may be allowed to do so. They should reimburse to government the expenses of their training and conform to departmental rules for training of qualified students for government service. On completion of their training government may grant them certificates of practical fitness.

this connection should be abolished altogether but that Executive Engineers should be given further powers to purchase stores locally. He therefore advocated an extension of the limit from Rs. 500 to Rs. 2,500.

4,733. It was preferable, in order to avoid the present duplication of staff in districts, that the Public Works Department should take over all district public works at least for the present rather than that government buildings and roads should be transferred to district boards. The latter system had been tried twice in the past and had failed. The first transfer, of which he had had no experience, took place probably during the eighties. The second transfer occurred about 1910 and its failure was due to the inefficient supervision of works by the boards. This drawback could not be met by merely insisting on district boards employing a more competent staff, as district board engineers were practically entirely under the control of Deputy Commissioners and there was an entire absence of a superior supervisory staff. The introduction of such staff might meet the difficulty, but it would not do away with duplication unless the whole of the government works in districts were transferred to the boards and not only a portion. Such a system would not, however, be workable since district boards were not at present capable of controlling even their own affairs, and the boards were not, in fact, sufficiently advanced in local self-government to take over the responsibility for government works in their respective districts. He had been a member of a district board about 10 years previously but he had not had more recent experience in such a capacity, as very few Executive Engineers had been elected members of district boards since 1911 or 1912. His opposition to the transfer of government works to district boards was not however only based on his own experience of 10 years previously, but also on his observation of the position of district boards at present. When on tour, he came across district board works almost every day and saw their roads and buildings under construction, and he had concluded from his observations that their works fell far short of the standard of work carried out by the Public Works Department. This inferiority, in his opinion, was due to the fact that the district engineer was the sole professional individual responsible for works and that he received orders from a layman, viz., the Deputy Commissioner, who allowed him too much freedom in professional matters. The position would be improved if a certain number of supervising engineers were appointed to control district engineers.

4,734. Full powers as contemplated by paragraph 329 (j), (k), (m), (n) and (o) of the Public Works Department Code, Volume I, should be given to Executive Engineers in the Punjab, since they were not exercised by these officers at present. As lower subordinates were borne on the circle establishments, Superintending Engineers, and not Executive Engineers, should be given powers to dismiss permanent lower subordinates. There was no objection, however, to Executive Engineers being given this power subject to an appeal to the Superintending Engineer. Similarly, Superintending Engineers should be given similar powers over upper subordinates subject to a right of appeal to the Chief Engineer and local Government. Such an enhancement of powers would tend to increase the efficiency of the Department as a whole.

4,735. Lower subordinates should never be placed in charge of sub-divisions. Selected upper subordinates might however be given such charges, and very few of them should be promoted to the superior engineer

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grade. A larger proportion of direct recruitment and a lesser proportion of promotion from the subordinate service should also be made to the engineer grades of the Department.

4,736. Completion certificates should be abolished altogether since they were the cause of a great deal of trouble with other departments, and it was not conceivable that an Executive Engineer who had carried out a particular work could not be entrusted to sign the completion certificate for it. When a work for another department had been constructed that department might be allowed to report whether its requirements had been met or not to the Chief or Superintending Engineer, but he did not think other departments were competent to state whether a work had been constructed well or badly. The Public Works Department should in this respect be free from outside criticism and if another department were not satisfied with, say, the accommodation provided for it, it might refer the matter to the Superintending or Chief Engineer, but judgment on the quality of the work should rest with a professional man.

4,737. He had recommended in his written evidence that there might be one imperial college of engineering for the whole of India in order to promote the constitution of an imperial service of engineers. In his opinion all engineers should be trained in one college, in order to receive a similar education under like circumstances; if there were three or four colleges one might be of a higher or lower standard than another so far as individual subjects were concerned. The present standard of instruction given at Roorkee was high enough for this purpose, but he had no experience of other colleges. It was more unjust, however, that candidates from places like Bombay should be given one appointment, while those from Roorkee were given six or seven, than that students from all parts of India should be required to attend one and the same college. He added that if all engineers were educated in the same institution, it would be advantageous in that they would come into contact with one another and with the Department generally, whereas this advantage would not be possessed by an individual educated, say, at Madras and transferred subsequently to the Punjab.

4,738. He had recommended that the theoretical course at the Roorkee College might be reduced from one of three years to one of two years as he considered it desirable that students should receive two years' practical training instead of one. Much of the time of the present course was, he added, wasted in the study of mathematics and science, which Indian students had usually mastered during their university courses. Hence he was not in favour of the retention of the present theoretical course with an additional year's practical training. Instruction in such subjects as applied mathematics had been included in the college course for the benefit of the non-Indian students. These latter were required to produce only a school leaving certificate which denoted the acquisition of a standard of general education equivalent to the matriculation standard, whereas Indian students were not able to appear for the Roorkee entrance examination unless they were graduates of a University. Hence the qualifications required of both Indian and non-Indian students should be the same. It was not necessary, in view of the fact that certain subjects were taught over again, that students should start an engineering course after graduating, and entrance to the college should be made permissible after the intermedi-

ate examination. In his opinion it was desirable that engineers who so desired should be allowed to specialize in engineering at an earlier age than was possible at present.

4,739. Every student turned out by an engineering college should be given the opportunity to obtain a certificate of practical training, such of them as were not selected for government appointments re-imbursing the expenses incurred by government in affording them a practical training. It was true that Indian students were usually too poor to meet the cost of such a training, but as government would undertake to bear the initial expenses, the students should from a business point of view re-imburse the outlay incurred on their account, and make it their business to obtain the necessary funds before entering an engineering college.

4,740. A system of study leave similar to that existing in the case of certain other departments should be introduced in the Public Works Department, in order to enable engineers to specialize in foreign countries in the several branches of engineering. He preferred specialization on the completion of the engineering course, and that only those who had shown special aptitude for certain branches of engineering should be allowed to specialize in those branches.

4,741. (Mr. Cobb.) He admitted that he had suggested in his written statement that "it should be made a condition of entrance into the Roorkee College that every student should have passed the B. A. degree examination of a recognized university," but reiterated his willingness to accept the intermediate standard, since he did not consider the B. A. degree very essential. All that was essential was to ensure for all students a uniform standard of general education and also education in certain special subjects.

4,742. Promotions in the Public Works Department should be regulated by reference both to seniority and merit. The present government rule to the effect that Assistant Engineers might be promoted by seniority if considered fit to hold charge of a division should, in his opinion, be strictly adhered to.

4,743. (Rai Bahadur Ganga Ram.) Though he appeared before the Committee as the representative of the Punjab Engineers' Association, it was his personal opinion that it would be sufficient to fix the intermediate standard as the standard of general education required of students who wished to enter Roorkee. Students who had attained this standard were quite capable of undergoing an engineering course in two years, since the Roorkee theoretical course formerly had been one of two years' duration. He did not desire to debar B. As. from entrance, but merely to do away with the necessity for obtaining a B. A. degree. The age for admission should accordingly not be reduced so as to debar B. As. from entering the college. The idea of the Association he represented, however, was to fix the B. A. standard for both Indian and non-Indian students.

4,744. (Sir Noel Kershaw.) It would be better for the *esprit de corps* of all engineers if an imperial service of engineers who had been educated in one central institution were established, and the Roorkee College was well suited to the purpose. He would not, however, like to see Madras selected as the city where such a college might be established, and suggested Delhi as an alternative. All provinces should possess their own colleges for training upper subordinates, as such men should not be trained along with engineers.

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At Simla, Friday, 13th April 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., L.O.S. (President.)

SIR NOEL KERSHAW, K.C.B.

G. S. COBB, Esq., M.V.O.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

D. G. HARRIS, Esq. (Secretary.)

H. T. KEELING, Esq., C.S.I., A.M.L.C.E., Chief Engineer and Secretary to the Chief Commissioner in the Public Works Department, Delhi Province.

Written Statement.

4,745. (I.) Economy and suitability of methods of execution of public works.—In giving my opinions on the points referred to the Committee in the Government of India's Resolution No. 06-E.A., dated Delhi, 24th November 1916, I have taken the points in paragraph 2 of that resolution *seriatim* so far as it is possible to do so. Reading the first point alone, it appears that the word "execution" does not connote the prior and necessary step of estimating; if however the second point is read with the first, it would appear that word "execution" does connote the prior step. Omitting for the present all questions relating to estimation of costs, the methods of execution now in use are three, viz., (1) departmental, (2) piece-work, (3) contract.

(2) The first named method is in use only for isolated pieces of work for which it is not possible to fix a job price or piece-work rate. The second method is probably that most used throughout India. The third is sometimes used in the *mofussil* but more generally in the presidency and larger towns only, the reason being that it is only in the latter that there is a sufficiently constant volume of work or business to make it worth while for any one to set up in business as a contractor. It may here be noted that all piece-workers in India style themselves "contractors" and that much confusion of ideas arises from this fact. With regard to the classes of work which the three methods are used for, the first method is only used for such work as mending a chair, putting in a pane of glass, driving and stoking an engine and sundry work in machine shops and so forth. All the remainder of the work in India is carried out either by the second or third method. The essential difference between the two latter methods is that, under the second method, the piece-worker is a purveyor of labour and the co-ordination of the efforts of the several piece-workers employed on any work is carried out by the Executive Engineer in charge; whilst under the third method the co-ordination is carried out by the contractor, who may or may not supply his own plant. If he does not supply his own plant, government pays for the necessary plant and either charges hire or supplies it free.

(3) It is evident that even if a contractor is employed on any work, some staff must be resident to pass the work, to measure and bill for what is done and to supervise the proceedings generally. The contractor deals with labour through a piece-worker or purveyor of labour and the latter deals with his labourers as a rule on a task work system. The intervention of a contractor in the European sense of the term must therefore generally speaking raise the cost of any particular job above what it could be carried out for on the system usually in vogue in the Public Works Department.

(4) If all work were executed on the contract system, the only saving government could look for that might counter the rise in cost of works would be a saving in cost of establishment, pensions and furlough pay. It is quite impossible to say definitely whether the reduction in establishment and cost of pension and furlough pay would counteract the increase in cost of work. Public Works Department establishment in the *mofussil* is

largely employed in a multitude of seemingly unproductive correspondence connected with the general administration of the country and with accounts both of which would still continue whether contractors were employed or not. Judging from my own experience, the execution of large works is cheaper under government organization than if executed under contract. It is however frequently more convenient to execute works in the presidency towns on contract rather than to temporarily engage more establishment. If the volume of the work to be done is so considerable and steady that there is sufficient inducement for persons to set up as professional contractors and there is a sufficient number of reliable firms to produce healthy competition, then it will probably pay government to execute works on contract. From the point of view of practical politics and economy it is in my opinion quite impossible and foolish to attempt to lay down any rules as to the methods by which works should be carried out. The Department will naturally use the agency which is cheapest and most convenient in the circumstances of each case. In the presidency towns, the tendency will probably be to increase the number of works done by contract proper but in the *mofussil* there will probably be no tendency in that direction for another generation or so.

4,746. (II.) Encouragement of other agency.—As regards designing and estimating previous to execution, most of the government original works now executed are administrative buildings of standard designs and water and sewerage works of special design and the major portion of the material for the latter must be imported. There is practically no scope for private enterprise where buildings of standard design are concerned, and water-works and sewerage schemes require to be designed by persons having the necessary training and qualifications. In my opinion it is only in the latter direction and in regard to a few public buildings of special design that any scope exists for private enterprise. The latter may or may not become more numerous. Both of these offer opportunities for private enterprise in design and construction and I point out later the lines on which private enterprise might in my opinion be encouraged. As regards maintenance of works after construction, it is not in my opinion a practicable proposition to hand over the maintenance of buildings, roads, and so forth to a contractor. It was tried as regards roads in Malabar some years ago and given up after a trial lasting some years.

(2) The Public Works Department Code provides for the execution of small works and ordinary repairs by civil officers as Public Works disbursers. Not nearly enough use is made of this provision and it is no uncommon occurrence to find the repair of a post office costing more for travelling allowance and pay than for the work itself. Examples are easily discoverable from the provincial budgets.

(3) The Public Works Department should not in my opinion as a general rule undertake any repair work. If a Collector or Deputy Commissioner is unable to make arrangements for white-washing and painting his district offices, which is a matter requiring only common sense

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and honesty, it seems to me that he is *ipso facto* unfit for his post. Similarly, there is no reason why a post master should not be called on to arrange for keeping his post office in repair. Both persons have to do so in the case of private residences and do it; why should they be incapable of doing the same for their offices?

(4). The General Branch also carries out a large number of relatively unimportant works such as sub-registrars' offices, small police stations, and in certain provinces, a large number of works which properly speaking should be dealt with by the local bodies. In all provinces, there is a great amount of work undertaken each year which does not require any high engineering training and upon which it is sheer waste of money to employ a Bachelor of Science. Without the details of budgets to refer to, it is however quite impossible to quote specific cases. I have, however, recollections of districts in which there were many cases where it would have been economical to entrust the government work to the local body and where it would have been quite feasible to do so.

(5). In a few other ways, government undertakes work which ought in my opinion to be left to private enterprise. For instance, it was no uncommon thing in Madras, when applying for a building grant-in-aid of a school or a hospital for the applicant to submit a design drawn by a *mistri* or draftsman on about Rs. 20 per mensem, which design could not possibly be accepted as it stood and for government officers to be asked to rectify it, which meant of course re-designing. I understand that this is the case in other presidencies. Neither government, district board or municipal employes ought to be permitted or asked to do work of this kind, and a very simple building Act and local bye-laws would effect the desired result. One of the provisions of the Act should be that all buildings must be designed by persons with specified training and qualifications.

(6). With regard to the design of water-works and sewerage works, there are but very few persons or firms in this country who could at the present time undertake the preparation of major schemes and, therefore, for sometime to come, the greater number of the larger schemes must be prepared as heretofore. There are, however, a number of small schemes the preparation of which might well be left to the numerous young Indian engineers who have been trained in England and who are now without work or opportunity of obtaining work in India.

(7). In general terms, these proposals mean that the Public Works Department should confine its energies to dealing with purely engineering matters and large building schemes, leaving all repairs and small works to the several departments concerned in the case of the former and to local bodies in the case of the latter. Private enterprise may be gradually permitted to undertake schemes of greater and greater importance. If this course is pursued, a professional class of standing and experience will in time be developed. It must, however, be borne in mind that it cannot be developed in one year or ten, and that it is a matter of, at the very least, a generation and a half. Similarly, with regard to public buildings not of standard design, scope might well be given to the young architect by government and local bodies refusing to design any contribution works or to re-design buildings of unacceptable design for which a grant-in-aid is sought.

4,747. (III.) Changes in organization.—The foregoing recommendations involve reorganization of the Public Works Department staff on lines which would ultimately result in a much smaller government engineering establishment and connote improvement in the staff in the employ of local bodies. This, I think, could be effected somewhat as follows:—

Their requirements as regards qualifications will vary largely but will vary mainly in direct proportion to the average funds available for expenditure.

(2). Division of local bodies into three classes.—The local bodies should, in the first instance, be divided into three classes on their works expenditure. For a certain but gradually increasing number, comparatively speak-

ing high qualifications will be required and with a view to securing this end, the government should establish an examining board the standard of which should be higher than that required for a diploma from the Indian colleges of engineering and should allow both Indian and English-trained men to appear for this examination up to the age of 26 or 27 and should enact that the first class of local bodies must not employ any engineer who has not passed the examination. The second class of local bodies should not be allowed to employ any engineer who does not hold a diploma as an engineer from an Indian college or a diploma of equivalent standing. The third class should be prevented from employing in local charge any person with technical qualifications of a standard lower than those now held by an upper subordinate and should be encouraged to amalgamate so that two or more conveniently situated could be run *qua* works as second-class.

(3). After the lapse of some time and when a considerable private professional class has arisen in the country, the necessity for a government board of examiners will probably disappear and local bodies would select men from the successful private practitioners.

(4). Reorganised on these lines, all the government works could be undertaken by the local bodies, reserving the larger and more complicated enterprises to be undertaken by government. The general scheme connotes that contribution works, such as non-government school buildings, hospitals and dispensaries for which government gives a grant, village and small urban sanitation schemes carried out partly or wholly from government funds, should be designed and carried out by private practitioners. In cases where a government grant is given, the scheme, when not prepared by a government officer, should first be passed by a government officer as suitable. On this being done, the government share of the fees (in the case of a private practitioner) should be paid to the local authority, the balance of the grant being withheld until the completed work has been passed as up to specification and according to accepted design. Similar provision, *mutatis mutandis*, to suit local circumstances should be made in the case of government contribution works carried out by local bodies. Under such a system, government engineers' work would tend, as the system developed, towards that of Local Government Board Inspectors in England and as the system developed in that respect, recruitment to the government cadres from England would diminish until the time came when it could be abolished entirely and recruitment to the government cadres (many of the appointments on which might be then non-pensionable) would be made entirely from private practitioners and from the successful engineers in the employ of local bodies.

(5). Were the Department reorganised on the lines sketched above the transition stage would not in my opinion be insuperably difficult to arrange for as the change must be gradual owing to the existing establishments. As circumstances vary in each province, they would have to be worked out in detail locally but in the first instance it would be possible with a stroke of the pen to throw all educational, ecclesiastical and medical contribution works and minor sanitary contribution works open to private practitioners and it is practically certain that the demand for them would create a supply. In addition to these works, probably there are districts where the local body might at once take in hand their own engineering work and if a suitable staff were employed by them they might also take over minor government works. In all Madras districts the local bodies now carry out their own work and where this staff is sufficiently well qualified all the smaller government works might be undertaken by them. The proposal also connotes, that ultimately Public Works Department charges within a province will cease to be territorial and will be by convenient grouping of works. This is a radical change from generally accepted ideas. I wish it to be clearly understood that I am not of opinion that the whole of the above proposals can be carried out at once or in the immediate future. It is a change which in view of the

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establishment at present engaged must perforce be gradual and so far as I can judge it will take some 25 to 30 years before all governments could get rid entirely of the smaller works appertaining to local bodies and probably another 25 before all government engineering establishment would be reduced to the minimum. Progress in this direction, however, very largely depends on the prospects offered to successful men. If the prospects are not similar to those lawyers can now look forward to, the best brains will never be attracted and all really large and important works will devolve on government for all time. By this I mean that the scale of fees payable for professional work should be the same as that payable in England and that if necessary legislation should be undertaken to achieve this end.

4,748. (IV.) *Relations with other departments and sub-branches.*—With reference to the organization of the various branches comprised under the general branch, viz., sanitary, architectural, electrical and civil engineering, I consider that it would be a very great mistake to make four separate departments. Much overlapping of work and functions and want of co-ordination would inevitably result. I am very strongly of opinion that all should be incorporated in one Public Works service. All should be on one cadre on similar pay. That is men employed chiefly in execution and assisting in designs should be brought on the cadre of the service on pay varying from Rs. 380 to Rs. 1,250, while all administrative appointments in each branch should be what are now generally termed Superintending Engineers' posts, i.e., the Consulting Architect, Electric Inspector and Sanitary Engineer would have the status and pay and prospects of a Superintending Engineer. The head of the General Branch should cease to be called Chief Engineer and should be termed Director of Works and Services. Appointment to this post should be made entirely by selection from any of the specialist branches of the General Branch who may be marked out as suitable by reason of administrative ability, character, tact and general technical qualifications to co-ordinate the functions of the specialists. The scope of the duties of the Architect and Sanitary Engineer in Delhi are those of an inspecting officer in so far as it is necessary in order for them to see that proper effect is given to their designs and they are entirely untrammelled by executive matters so as to have as much time as possible for designing and inspection. The Electric Inspector is on the same basis except that at present he carries out executive duties as well. This however is a purely temporary arrangement due to the circumstances of the work up-to-date. The officers in charge of these branches have informed me that they are satisfied with the working of this system. The functions of these officers and the general engineering questions are co-ordinated by myself and they work in harmony without friction with the general engineering and construction side.

(2). I see no reason against and every reason for believing that such a system applied to the larger needs of a large province must work better than entire separation. Opportunity will doubtless arise later for an explanation and examples of how recruitment would be made under this system.

4,749. (V.) *Decentralization.*—Further decentralization and enhancement of powers within the Public Works Department is extremely desirable and the latter would save much correspondence in all administration and audit offices.

(2). A few instances are given below :—

(a). *Books and periodicals and newspapers.*—Powers of purchase are vested in local Governments who are authorised to delegate such powers to heads of departments and other selected officers.

(b). *Stationery, rubber stamps, etc.*—Powers of local purchase are vested in heads of departments up to Rs. 20 for each purchase. Similar powers may be delegated to heads of offices.

(c). *Local printing of miscellaneous forms.*—Requires sanction of Superintending Engineers.

(d). *Recurring contingent charges.*—Powers to incur recurring contingent charges are vested entirely in local Governments except in cases where the cost does not exceed Rs. 10 per mensem and is not for more than six months.

In all the above cases, full powers should be vested in Superintending Engineers and monetary limits should be fixed for Executive Engineers within which they should be permitted to exercise full powers.

(e). *Appointment of work-charged establishment.*—Executive Engineers' powers are limited to appointments on Rs. 150 per mensem and Superintending Engineers' to Rs. 250 per mensem. Executive Engineers should exercise the powers now vested in Superintending Engineers and the latter should have full powers subject of course to the provision in the estimate.

(f). *Contracts.*—Executive Engineers' powers are limited to Rs. 5,000. These should be increased to one lakh.

(g). *Stock.*—Specially selected Executive Engineers can sell articles of stock at their full value up to a limit of Rs. 1,000; they can also dispose of unserviceable or surplus stores at their full value up to a limit of Rs. 2,500.

In all these cases full powers should be vested in Executive Engineers and the restriction in respect of the recovery of full value for unserviceable stores should be removed.

(h). *Imprest advances.*—The grant of imprest advances requires the sanction of the local Government. These powers should be vested in Superintending Engineers.

(i). *Journeys outside an officer's jurisdiction.*—Controlling officers should have full powers to permit any of their subordinates to proceed on duty within the limits of the Government of India.

(3). *Powers of technical sanction to estimates* should be largely increased and powers of administrative sanction in regard to Public Works Department minor works should also be increased. For instance, once the design for a building and approximate estimate for any large building has been approved by the administrative authority concerned, it should be dealt with as regards technical sanction by the Superintending Engineer concerned in direct communication with the Architect. Sanitary and electrical schemes should be dealt with in similar manner.

(4). *Restrictions on the local purchase of plant, stores and material* should be removed entirely and Chief and Superintending Engineers in charge of works should be given full powers to deal direct with manufacturers applying to an authority, preferably a technical one, at the India Office for assistance in inspection whenever required. In my experience, practically the only advantage obtained under the present system is a reduction in the price of material such as cement, steel and so forth, when purchase is made in large quantities. In the case of manufactured articles of plant and machinery, it is in my opinion more economical and quicker to permit the indenting officer to do business direct with the manufacturer without the intervention of a third party.

(5). Broadly speaking, I advocate measures which will give the administrative and executive officers directly concerned with any work or project full powers of sanction to carry out such work or project within the provisions of the administrative sanction without requiring by rule further sanctions of any kind whatsoever. If measures of this kind were taken, the Chief Engineer would be able to tour more than is possible at present and in many cases to form opinions on the spot, a procedure which would prevent much avoidable correspondence.

4,750. (VI.) *Simplification of procedure.*—The Code as it stands is antiquated, out of date and unduly restrictive, and productive of much avoidable correspondence and clerical work. For instance, it has been held that in preparing an approximate estimate for a work it is not allowable to provide any greater sum than 5 per cent for contingencies, and rises in rates during construction, and during the time that passes between the preparation of the approximate estimate and sanction. This means quite unnecessarily detailed work in the preliminary stages, as it is practically impossible for any one save

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accidentally to give an approximate figure within 5 per cent. of the detailed figure. Approximate estimates should be handled on broad lines and it should be permissible to provide as much as 15 per cent. for unknown or imperfectly investigated factors, but this being conceded no technical sanction should ever be allowed to exceed the administrative sanction. A change from the present to such a procedure would very greatly expedite business.

(2). Estimates are required for practically everything done by the Public Works Department, for instance, if I being a Public Works Department officer wish to purchase a *durri*, an estimate must be prepared and sanctioned; the *durri* is then bought. This however does not end the matter for the officer purchasing must enter the bill in a measurement book and when paid the transaction is shown in the cash book, and all the other account books kept, whereas if the audit officer who lives in the same building requires a *durri*, he orders what he requires, pays the bill on receipt, and enters it in his cash book only. If the *durri* is beyond his powers of sanction owing to its size or other cause, this is put to the authority having powers of sanction who gives or withholds it and in the event of sanction being given the letter is sufficient authority. There are numerous similar cases in which the preparation of an estimate and all the consequent clerical work this involves is quite unnecessary.

(3). With regard to reappropriation of funds from one work in progress to another, much delay occurs in this not lying wholly in the hands of the Superintending Engineer. At present if a Superintending Engineer finds that from any cause the executive officer can spend more than the grant on, say, a *kutcherry* in progress and that the executive officer cannot spend the grant on a court house in the same town, the reappropriation can only be sanctioned by government. The principle underlying the present usage is to let the several departments, in this case the Revenue and Judicial, agree to the transfer, as conceivably the Judicial Department may desire to spend the money at some other place some distance away. This may be right enough in principle but in practice it is not often workable in its entirety and the existing system often leads to lapses in grants. The principle underlying the system I propose is that the sanctions are what really matter *qua* departmental outlay and that the annual outlay will average out better and more economically and lapses will be less frequent than at present. This is realized in part now since towards the end of the financial year applications for such transfers are dealt with in the Public Works Department Secretariat without reference to the other departments. Why not treat the allotment of expenditure between the various departments wholly on the basis of sanctioned works, leaving the department carrying out the work to deal with grants to works and transfers from one to the other as may be required by the rates of progress which cannot possibly be uniform even in the same town?

(4). Among other points in which the Code is unduly restrictive are the rules for—

(a). Deviations from sanctioned estimate which to all intents and purposes give no latitude at all.

(b). Budget grants for works; it is objectionable to exceed any grant whereas lapses of individual grants are not objected to in audit.

(c). Establishment grants for other than temporary establishment are quite unnecessary and can be quite easily dealt with at circle or provincial headquarters. Divisions should be concerned only with works grants. In this connection reform is much needed in the appointment of draftsmen, overseers and other temporary establishment as distinguished from work-charged establishment. Each circle officer should be given a lump sum grant annually for the purpose and should be permitted to appoint within this sum without reference to any higher authority. Under the present system it sometimes takes three months and more to obtain permission to put on an extra draftsman whose services may only be required for a month.

(d). I give in an Appendix a short list of "gems" in the Public Works Department Code which are indicative

of the useless matter it contains (Annexure A). Broadly speaking the provisions of the Code are so restrictive that they lead to wholesale evasions and it may be truly asserted that most of the big works in India have been carried out in spite of the Code and not because of the Code. There is only one real remedy and that is to cast it into the fire and start afresh with a few sound businesslike and common sense rules, one of the most prominent of which should be that if there is no rule against any action taken it must be assumed that the action is legal. At present the Department is largely audited on the reverse lines with the natural result of an immense mass of quite useless correspondence.

(e). It is not out of place to make a brief reference to the accounts the Department is compelled to keep, which are quite unnecessarily cumbersome and complicated and do not afford the information required by an executive officer, which is to be able to ascertain at any moment how his expenditure stands against any estimate or sub-head of the estimate. The accounts require recasting.

4,751. (VII.) Education.—I have been at different times a Professor at the Engineering College, Madras, and Principal of the College and was for a period of some years on the College and University Boards of Examiners. During my short incumbency as a Principal in 1904-05, I raised the questions regarding the curriculum and the location of the college which resulted in the appointment of a committee to report on the matter. This committee submitted its report early in 1905 but its recommendations which were in the main accepted by government have not yet been given full effect to. The principal points that struck me about the students were (i) that the majority were mere seekers after government appointments and had not joined the college from a liking and desire for the profession of engineering and (ii) that the majority trusted to memorizing text books for the purpose of passing the examinations. This latter fact, I thought, was in some measure due to the teaching staff being inadequate in qualifications and numbers. A striking instance in this latter respect was the large number of students in many of the classes. So much was this the case that in one subject, estimating or quantity surveying, it was impossible for the teacher to give more than a few minutes personal attention in this subject during the whole of the student's college career. The disproportion was not so bad in other subjects, but it was and may still be striking. So far as I can ascertain from the calendar, it is still nowhere near a proportion of 1 to 11 which is the desideratum to be aimed at in technical instruction broadly speaking. I have not been in sufficiently close touch with the institution recently to give a firm opinion, but I much doubt the adequacy in numbers of the superior teaching staff and the numbers and qualifications of some of the subordinate teaching staff. Further, unless there has been a large reduction in the number of holidays in the collegiate year, it is not in my opinion possible to give full and proper instruction in the whole of the syllabus laid down in the calendar. In my experience as an examiner, I received several notes from the college authorities stating that the students had only been taken up to a certain point in certain subjects or a certain subject. This may have been and probably has been altered, but if it has not been changed so as to make it not only possible but certain, it follows that the actual scope of instruction is not up to the proper scope.

(2). There is one subject in which the Indian college student does not receive anything like the same amount of instruction as the student trained in England and that is in the matter of design. It is a most important point and handicaps him very heavily at the outset of his career. The Indian college so far as I have been able to ascertain to all intents and purposes leaves instruction in design out entirely or instruction is so meagre as to be practically negligible.

(3). The standard of success in a college is too often thecentage of passes instead of the quality. It is only the latter which really reckons for success and the former standard necessarily leads to a reduction in quality by reason of a lowering of the standard for passes.

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4,752. (VIII.) Practical training.—The practical training of students is more often inadequate than adequate. There are many reasons for this. Among them are (a) posting to places where the works in progress do not afford sufficient opportunities, (b) want of interest in the person immediately responsible for supervision, (c) restrictiveness of the Code which prevents the executive officer giving the student personal responsibility for the work entrusted to him. (The Code can be evaded and has been evaded in this matter by persons who are keen on training the young.) (d). Then again the fact that the majority of the students are only seekers of government appointments means that the majority do not avail themselves of the opportunities of learning that are given. I think that two of the remedies needed in this matter are more care in the selection of the place of training and person to whom students are sent for training and making it possible for and incumbent on the individual training the student to give the latter personal responsibility. I am also of opinion that it would be of advantage to have a whole-time touring officer supervising the practical training. It would then be possible for the executive officer's attention to be drawn to any defects in the practical experience the student is receiving at a stage when it would be possible to remedy the defect. It should be borne in mind that the executive officer in charge of a division is often a very busy man with but a modicum of spare time to devote to such matters and is very often unable to see personally what the student may be doing more than once or twice in the year.

4,753. (Conclusion).—The adoption of the proposals sketched out in the preceding notes would, it is thought, ultimately result in a department more highly trained and experienced, though much smaller numerically, than at present; a department which would be more or less completely relieved of an immense mass of petty work which can be done much more appropriately and economically by other agencies; and a department, the members of which would have leisure to grow in their profession and one which would have been revived because it has shaken off the fetters of a Code which had all but strangled it.

ANNEXURE A. GEMS.

SELECTIONS FROM THE PUBLIC WORKS DEPARTMENT CODE.

27

Code paragraph 27 clashes with the Civil Service Regulations (ordinary rules increments.)

1267

Appendix 6, paragraph 13.

Code paragraph 110 has been superseded by Civil Service Regulations 78-A but the Code rule still remains in the book.

110

Vide this paragraph.

427

The Public Works Department Code 483 differs from the Civil Accounts Code ruling on the same subject. (Audit office.)

483

Samples of index entries in the body of the Code.

505 and 507

The latter has a special ruling tacked on, (507).

577 to 579 and 584

Samples of rules which it was unnecessary to enter in a Code.

601 and onwards.

The rules regarding stationery, its supply, etc., are found also in the Stationery Manual.

632

Article 632 German or Turkish terms might presumably be employed.

637 and 638

Matters which it is hardly necessary to make a Code rule about.

808 and following.

Specially see 870—874—885 and 900.

893

Broken glass sometimes charged to "office contingencies" and sometimes "maintenance." See also note to 893—Definition of a *punkah*.

919

Article 919, I. (c). A large house on government land may have a smaller rent than a small house on acquired land.

922

Article 922 has been expunged. At the same time a circular has, it is understood, been issued to the effect that the substance of the rule is in operation. (Audit office.)

This article is in many respects meaningless.

Relates to uniform.

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4,754. (President).—The witness stated that he was the Chief Engineer in charge of the works connected with the New Capital at Delhi and that he was in his 30th year of service, the major portion of which had been spent in both branches of the Public Works Department in Madras.

4,755. The practice with regard to the execution of work in Delhi was to invite tenders for every work in excess of Rs. 5,000, and contracts were concluded on the piece-work form of agreement. Lump sum contracts were only given out in the case of small minor works, and though it was always open to contractors to tender in lump sum, the majority of the contractors who applied for works in Delhi and the neighbourhood, in spite of the fact that they belonged to the most influential class of Indian contractor to which works in the Punjab were given, were individuals who did not possess sufficient knowledge to frame estimates on which they could make a reasonable lump sum tender. With one exception, no tenders had been received from European firms of contractors for works at Delhi. He was not aware of the extent to which tenders had been advertised in the public press, but tenders were advertised in the local newspapers. The only really large individual works connected with the New Capital were the two central buildings for which the drawings were not as yet in such

a form as to make the invitation of tenders for the entire work feasible. The reason for this state of affairs was that, at the time when work first commenced at Delhi, it was decided to proceed with the works as the plans became ready rather than await the completion of all the drawings. About 2½ years would have elapsed before commencement of work was possible had the usual English practice been followed and it was therefore decided to deal with the work in sections instead of awaiting the completion of all the drawings.

4,756. There was no *prima facie* objection to the suggestion put forward in evidence for the encouragement of private enterprise that, where reliable firms of contractors were available, tenders for lump sum contracts should ordinarily be invited and accepted, even though such tenders might if accepted involve an expenditure slightly in excess of that which might be incurred if the works in question were carried out on the piece-work system. There was, however, a danger that individuals or firms, in order to ensure their being given a particular work, might tender for a lump sum contract knowing that in reality they were not able to carry out the work concerned, and also that officers of the Department might invariably accept the lowest tender. He admitted however that if the terms of the contract were adhered to by government, the likelihood of the former danger

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would disappear and stated that the evil would probably cure itself, though in the process of its curing it would probably ruin a considerable number of worthy individuals who at present worked quite satisfactorily under the ordinary piece-work system.

4,757. There was also no *prima facie* objection to the classification of contractors according to their reliability and financial stability, with a view to the encouragement of reliable private contracting firms and to ascertaining the extent to which supervision by the Public Works Department might be reduced; also to accepting the tenders of reliable firms in preference to those put forward by less reliable firms even though the tenders of the former were, on the whole, a small percentage in excess of those of the latter. He doubted, however, if the difference between such tenders would be as high as the figure put to him, viz., 5 per cent, which it had been suggested in evidence would represent the percentage of the present detailed supervision exercised by subordinates of the Public Works Department which might be dispensed with, and thought that it would amount to about 2 or 3 per cent only. It was true that engineers might experience difficulty in classifying their contractors and that numerous mistakes might be made during such a process, but the suggested classification would not be a very invidious task, as had been suggested in evidence, and if it resulted in the introduction of a better system than the one now in vogue it would be to the public advantage. On the whole, therefore, he expressed himself as decidedly inclined to advocate a trial of the system in spite of the objections that had been put forward in evidence to such a course.

4,758. The amount of subordinate supervision at present exercised by the Public Works Department over the work of contractors was not excessive, and it was not, in fact, more than was really essential. The many instances of ignorance on the part of subordinates were, in his opinion, the cause of private firms objecting to supervision, especially when exercised by individuals in the lower grades of the subordinate service. But a superior officer who understood his work well could invariably override an over-zealous or ignorant subordinate. He admitted however that such a check could only be easily exercised in the case of concentrated works like those at Delhi and that it was not nearly so easy in the case of scattered works. But nevertheless he disagreed with the contention put forward in evidence by representatives of private enterprise that the amount of the subordinate supervision exercised at present by the Public Works Department was excessive.

4,759. Provided sufficient healthy competition were ensured, there was no necessity for government to supply bricks to contractors. He therefore agreed with the contention put forward in evidence by representatives of private enterprise that, where an ample supply of bricks could be obtained from private firms, there was no necessity for the Public Works Department to maintain the brickfields that had been established in certain parts of the country. This opinion was however subject to certain considerations, one of which was the quantity of bricks required. Such quantity might influence the decision of government as to whether they should supply a contractor with bricks or not. For instance, when 40,00,00,000 of bricks were found to be needed in Delhi, it had been found more economical to invite tenders for their supply from separate contractors. In the case of certain individual works however such as Government House, the contractor who had been engaged for the work was one of those who manufactured bricks.

4,760. Provided the cement a contractor intended to use had been tested at the site of work and found to be up to the ordinary English standard specification, there was no necessity to specify the place from which contractors should obtain cement, or to insist on the use of government cement only. The price of cement was at the present time extremely high owing to war conditions. It was not necessary under normal conditions for the Public Works Department invariably to make arrangements for the supply of this material to con-

tractors. It should be left open to each individual officer to decide whether to invite tenders for the supply of cement or not.

4,761. He had personally found that it was preferable to deal with manufacturers direct. Hence he adhered to the view in his written statement that, in so far as the Buildings and Roads Branch of the Public Works Department was concerned, there was no need to indent on the Secretary of State for plant of European manufacture. In his opinion an engineer in charge of a building could obtain such plant as was required sooner and more economically by purchasing direct from the manufacturers. The tests undertaken by the India Office were as a rule carried out on the material during the process of manufacture. For instance, if a steam navy were being manufactured, test pieces were attached to certain portions of it, and as each such portion was made it was cut off and sent to the laboratory. On the result of such a test the materials for the making of the steam navy were either accepted or rejected. Most reliable firms in England carried out their own tests, and those were sufficient for the ordinary articles that were usually indented for.

4,762. There was no necessity for the maintenance on a large scale of Public Works Department workshops, provided there was healthy competition among private firms. To dispense with government workshops in the absence of such competition however would practically induce monopolies, and these should always be avoided if possible. Though adequate public competition might be secured in places like Bombay and Calcutta, he was doubtful whether the output of the government workshop in Madras was such as to induce firms other than those already established in that presidency to set up workshops. He was here informed that the government workshop in Madras was at present an extensive one, and stated that he had not seen it since 1912 but that he knew it was proposed to increase its extent at that time as it had been found that cheaper work could be carried out in it on the whole than it was possible to obtain from the few firms in Madras which were in a position to quote prices. He agreed that cheapness was not the only element to be taken into consideration in connection with the question of the abolition or retention of Public Works Department workshops, and that the industrial advancement of the country had also to be considered, and repeated that it was only necessary to maintain government workshops in the absence of healthy competition.

4,763. It was not possible on the spur of the moment to furnish figures showing the actual percentage charges of establishment as compared with the cost of the concentrated works at Delhi, as the question had been complicated by the inclusion of Architects' fees and the cost of investigation. Such figures as he might furnish, therefore, would not be reliable in so far as the ultimate cost of the works was concerned. It had been estimated however that the total establishment charges, inclusive of Architects' fees, etc., would ultimately amount to Rs. 86 lakhs, out of the total estimated cost of Rs. 917 lakhs. About Rs. 31½ lakhs had already been spent to cover establishment payments. Of this Rs. 8 lakhs had been paid in fees to the Architects, Rs. 2½ lakhs for contingent charges incurred on preliminary investigation, such as the expenses of the Town Planning Committee, etc., and about Rs. 1,40,000 on the Imperial Delhi Committee. The balance had been spent on the engineering and architects' staff and the men immediately engaged at present on the works. As a great deal of the work that had been undertaken up-to-date consisted entirely of drawing and designing, etc. the ratio of the Rs. 31½ lakhs to the actual cost of the work carried out up-to-date did not represent the true cost of establishment to works. It appeared, in the early stages in which the Delhi project was at present to be unnecessarily high, and it was in fact higher than what it would ultimately be when the works were completed. The fact that the funds allotted for the Delhi project had been reduced did not influence the question, since only a comparatively small sum of money had been spent on the central buildings. Three

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per cent. had however been paid as Architects' fees on the major portion of the estimated cost and the estimated cost of the two central buildings together amounted to a little over Rs. 2 crores. Taking the estimated figures, however, of Rs. 80 lakhs and Rs. 917 lakhs, about 9 per cent. was probably what the percentage cost of establishment on the concentrated works at Delhi would ultimately amount to, but this percentage might be lowered in certain instances. There were special circumstances in the case of Delhi which had increased the cost of establishment somewhat, viz., the expenditure incurred on the Town Planning Committee in the first instance and subsequently on the Imperial Delhi Committee, and also the percentage paid to the Architects, who received a higher percentage than they would have received if they were working for the Board of Works in London. On the engineering side alone the Architects were paid 3 per cent. instead of 2, and this advantage of one per cent. had been given to them by the Secretary of State.

4,764. He recommended with a view to the encouragement of private enterprise that the Public Works Department should refuse to design and carry out contribution works for private bodies, i.e., works constructed with the assistance of a government grant-in-aid, and that the Department should leave both designing and construction of such works to private agency. Such a course would induce the private body concerned in each case to utilize the services of an architect for the preparation of a design when a building work was proposed. Since the architect's fees in such cases would be included in the total cost of the building of which government would bear their share, he did not agree that his experiment would increase the difficulties already experienced by that class of body in getting designs and work executed and that it was the least likely experiment to ensure the success of his scheme. Nor did he agree that in preference to contribution works the experiment he had suggested should be made more at government expense on Public Works Department works. With regard to the fact that contribution works were usually scattered over the province and that this made it difficult to secure architects to design them or an agency to construct them he thought that the demand would in time create the supply. He admitted, however, that there would be difficulty and that his scheme might be more expensive than the alternative suggested to him, but considered that his scheme would eventually be found to be advantageous. He was then informed that it had been contended in evidence that, in connection with a school at Moradabad, difficulty had been experienced by a certain private body in securing plans and designs that would pass the scrutiny of the Public Works Department and the scheme had had to be dropped after frequent trials, and he elicited the information that the body concerned had not utilized the services of a qualified architect. He then pointed out that if the private body had employed a well-known firm of architects, one of those established in Bombay or Calcutta, for instance, they would not have experienced the difficulty they had. He drew attention to the fact that he had in his written statement suggested that government might in certain cases utilize the services of private firms, and emphasized his contention that the demand for architects would ultimately create the supply, in spite of the fact that in the immediate future difficulty might be experienced in securing architects to prepare designs for contribution building works. Difficulty would undoubtedly be experienced in respect to the construction of contribution works, but if the system he had recommended were persisted in the demand in this respect also for suitable qualified persons would eventually create the supply. He saw no reason why India should be an exception in this respect to other countries, and remarked that it would eventually be of advantage to the country if an independent professional class were created.

4,765. Repairs to all government buildings should be made over to the departments in occupation as an enormous amount of petty repair work which did not require the services of engineers was at present performed by engineers of the Public Works Department. To the

contention that such a scheme had been tried in certain provinces and found to be uneconomical, e.g., that in one particular province a comparison of an actual calculation of the amount spent on repairs by a particular department with the normal amount spent by the Public Works Department had shown that the former was more expensive, he replied that he did not anticipate that his scheme would on the whole be more expensive, though isolated cases to the contrary might undoubtedly occur. For instance, if an individual estimate for a building were taken, it might be found that a local officer had possibly spent Rs. 500 instead of Rs. 300 in one case and Rs. 400 instead of Rs. 300 in another case, but the total amount spent might nevertheless be really an inappreciable percentage on the capital cost of the building concerned. The question to be considered was what relation the cost of repairs bore to the capital cost of the works repaired and whether this relationship constituted a really high percentage or not. He did not agree with the contention that the responsibility for repair work to departmental buildings would be detrimental to the several departments, in that it would interfere with the legitimate duties of the officers appointed to carry out the repairs, since there was no need for a departmental officer to be too particular about the ordinary annual repairs and to insist on ascertaining whether, say, the paint used was good, or whether it had been properly applied, or whether exact measurements had been taken. The officer in charge of repairs need only ascertain in the case of a building worth about Rs. 5,000, for instance, that the expenditure on the annual repairs did not exceed between Rs. 100 and Rs. 150, and also that the repair work carried out was of a reasonably good quality, and insist on the building being kept in good repair. It was true that under such a scheme power would be delegated to subordinates, but this fact could not be taken as an important argument against the scheme as the extent of such power would be limited to small sums only. The contention that in the Police Department, where the system in question was most commonly in vogue in India, the system had introduced abuses on the part of the police in the shape of employment of forced labour at inadequate rates and the forcing of *zemindars* to provide free materials, etc., could easily be met. As the professional supervision usually required, for instance, for white-washing and painting, say a police *chowki* or *chaildar's kutcherri* was practically nil and the cost extremely little, he did not agree that petty repairs could not be undertaken in India in the absence of professional supervision owing to the fact that the building trades in the country were not developed to the extent that they were in more advanced countries, where petty repair works were undertaken by jobbing builders or painters. The plea of ignorance as to the distinction between good and bad white-wash, or between mud-wash and lime-wash, put forward by a certain police officer was decidedly an exaggeration of the difficulty, and such an officer, after spending Rs. 150 on repairs to a police station, would soon find out whether the work was not up to standard when carrying out his next inspection.

4,766. With a view to meeting the Public Works Department complaint that the burden of repair work fell heaviest on their officers in cases where buildings were scattered over the district away from headquarters, an alternative suggestion to the effect that only such scattered repairs might be transferred to the several departments concerned, the Public Works Department retaining charge of the repair work of buildings at headquarters stations where their officers were in a position to more easily supervise works, was put to him. He considered that this was possibly one stage worth trying in the first instance, but thought that eventually the repair work connected with buildings at headquarters stations should also be transferred to the departments which occupied them. He surmised that the idea underlying this alternative suggestion was the establishment by government of an estate agency at headquarters stations, for instance, Delhi or Simla, to undertake the whole of the maintenance of important government

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buildings. In view of the fact that the Public Works Department at present utilized the services of local labour in out-of-the-way places, he disagreed with the contention that the several departments of the administration might object to carry out repairs to their respective buildings in such places on the ground that they were rendered difficult to execute by the absence of a contracting agency.

4,767. It would be merely establishing another department as it were if the repair work at present carried out by the Public Works Department in districts were transferred, not as he had suggested to the several departments in occupation, but to the district board engineering staff. Further, the effect would be that the evil from which the Public Works Department suffered at present would be transferred to another engineering staff. The general policy which should be adopted was to work the district board engineering staffs up to the highest possible pitch of efficiency.

4,768. On being informed that certain witnesses had gone further than he had and suggested, in order to afford additional relief to the Public Works Department, that each department might carry out all their minor works in addition to the annual repairs to their buildings, e.g., that if the Police Department desired to construct a work worth under Rs. 2,500 they might be allowed to do so; he pointed out that in certain provinces, such as Madras, the Police Department at present undertook the construction of not only individual, but also of several building units, the aggregate cost of which did not exceed Rs. 2,500. Petty works did not necessitate, as had been contended in evidence, the supply to departments of a subordinate construction agency, as such works generally needed merely the application of common sense and the majority of them merely involved the addition of a bath-room or a verandah to a house, etc. The erection of a police *thana* or other building of a similar class was however a different matter, and in such instances the services of the local district board staff, if conveniently situated, should be secured. District boards usually had a member of their staff resident in places where there happened to be a large *thana*.

4,769. In connection with the suggestion that in places where the Irrigation Branch and the Buildings and Roads Branch were entirely separated, the former might take over the construction and maintenance of all buildings in the area under their charge, much on the lines of the system which was at present in force in Madras, he stated that he was not sufficiently acquainted with the circumstances of certain provinces in Northern India to be able to state definitely whether such a scheme was feasible or not. Irrigation in Madras was quite different from irrigation in provinces like the Punjab or the United Provinces. For instance, in Madras the chief crop grown was rice, whereas in the Punjab and United Provinces the staple crop was wheat. The rice crop needed say 60 inches of water in Madras whereas the wheat crop in the Punjab and the United Provinces would probably need but 12. The absence of one inch of water from the wheat crop constituted a far greater percentage than the absence of one inch from the 60 required for rice. Consequently, the attention required in the distribution of water was far greater in the Punjab and United Provinces than it was in Madras. He was however definitely of opinion that the system existing in Madras, under which an irrigation engineer attended to all works in the area under his charge, was in circumstances similar to those in Madras both workable and economical.

4,770. There were three distinct engineering staffs in the majority of the districts of the Madras Presidency, viz., the district board staff, a minor irrigation establishment under the Collector and the Public Works Department establishment. Outwardly, the proposal that the minor irrigation staff under the Deputy Commissioner should be transferred to district boards with a certain proportion of the revenue derived from the minor irrigation tanks, with a view to encouraging the boards to take an interest in the maintenance of the minor tanks in their respective districts, appeared to be a workable

proposition. But he desired to go further and to add to the number of works so transferred, on the same basis, many of the irrigation works which were at present maintained by the Public Works Department. The effect of such a course would be to leave practically only two agencies to attend to public works in certain of the Madras districts. He also confirmed the suggestion in his written statement that it might be found possible to go still further and to transfer the construction of small building works also to district boards by the payment to the boards of a percentage for establishment, and suggested that district boards might at the commencement be allowed to deal entirely with buildings worth Rs. 10,000 and less. In view of the fact that the capabilities of district board engineers varied considerably, however, and that it might be possible in some districts to transfer to district boards buildings worth a larger sum than Rs. 10,000, he was not averse to an increase in this limit whenever it was possible. He contemplated that district boards should ultimately take over all works in their respective districts with the exception of large and important building projects.

4,771. With regard to the suggestion in his written statement that district boards might be classified into three classes, he stated that he had a short time previously, in connection with questions which were asked with reference to a note written by Sir John Ottley on recruitment in India, interrogated several Indian engineers who had been trained in England and in India with a view to ascertain whether they approved of a competitive examination conducted in England up to, say, the standard of the London University, but without any restriction on the number of Indians or the number of Europeans who would in consequence be appointed to the service. These officers had replied that they would not like such a scheme as the ordinary Indian engineer who went to England for training and in order to obtain an English degree, was not as good at drawing as the man who had been trained in an English college; in other words, that Indians suffered from a lack of instruction in draughtsmanship and in designing. They had also stated that the result of an examination, such as he had suggested to them, would be that comparatively few Indians would secure appointments in the service in India. In view of this, and as he wished in connection with the scheme he had suggested to secure for first-class district boards and municipalities the best Indian talent available in the country, he was of opinion that an examination should be instituted which would induce Indian colleges to raise their standard of instruction in the direction indicated.

4,772. The witness was here informed that the bulk of the evidence that had been furnished to the Committee had been to the effect that the theoretical standard of instruction imparted in the Indian engineering colleges was sufficiently high and fully adequate, and he was asked whether he intended that a still higher theoretical course should be introduced in order to enable students to appear for the examination he had recommended. He replied that his intention was really to test whether the engineers examined were able to apply their theoretical knowledge practically in so far as designing was concerned. He admitted, however, that from the point of view of the prospects of the engineers employed by boards other than first-class district boards, his scheme was an undoubted drawback, in that its effect would be to debar such of those officers as had proved themselves to be capable engineers from promotion to first-class district board appointments.

4,773. He recommended that all road maintenance should be transferred to district boards, including that of major trunk lines, and that in order to adequately secure a uniform standard of maintenance, which was the present impediment in the way of such a transfer, the boards might be aided by government grants and inspections of their roads by government. It would not be necessary for the Public Works Department to maintain an establishment for the survey and preparation of new road projects subsequent to the suggested transfer since such work could in certain instances easily

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be attended to by the district board establishment concerned, and where two or three district boards were affected an outside establishment temporarily engaged for the purpose might probably prove a better expedient. A really efficient district board staff should be quite able to handle the survey and preparation of a new road project. It was true that the present staff of certain district boards was really not competent to undertake such work, but what he desired to introduce was a scheme which would bring all district board establishments up to the necessary degree of efficiency. He added that if such a scheme were introduced gradually, and with due care as to results, it would ultimately lead to the Public Works Department being left with only the important and large building projects in the several districts.

4,774. He also contemplated that ultimately, i.e., about 25 or 30 years hence, large building projects might also be transferred from the Public Works Department entirely to architects belonging to an architectural service.

4,775. Such a service could be established in each province and be equivalent approximately to the Office of the Commissioner of Works in London, though not on precisely parallel lines because it would need modification to suit the circumstances and area of the country.

4,776. Provincial Sanitary Engineers would in due course possess construction staffs of their own and the functions of the civil engineer would practically be reduced to the inspection of local works; possibly also the preparation and scrutiny of general schemes for industrial development in cases in which the support or advice of government was needed. The fact that the civil engineering inspection staff would under his scheme eventually be filled by men in the later years of their professional life met the contention that it was unsound in principle to have an engineering staff employed merely on the inspection of works under construction and the scrutiny of plans prepared by another agency, as such a staff would eventually deteriorate from an engineering point of view unless a certain amount of construction work was given to it. In this connection he drew attention to the fact that he had not in mind the immediate future, but rather the conditions a generation or more ahead for which it was desirable to organize now.

4,777. After the introduction of his scheme the Public Works Department staff in each province would be restricted to a Chief Engineer or, as he had termed the appointment in his written statement, a Director of Works, and a certain number of Deputy Directors in charge of special branches. One of these latter officers would be the Sanitary Engineer with a construction staff for sanitary works, another the Architect who would be responsible for the construction of major building works, and a third the Electric Inspector. Wherever the duties of these officers overlapped they should consult each other, and when a difference of opinion occurred the matter in dispute would be submitted to the Director of Works for decision.

4,778. Recruitment to the specialist posts of the service should be made from among men who had proved their worth in private practice. Under his scheme there would fifty years hence be several Sanitary Engineers in each province in municipal or private employ, and on the retirement of a provincial Sanitary Engineer, i.e., one of the Deputy Directors of the service, a successor might be selected from among the several municipal and privately employed Sanitary Engineers after consideration of their individual qualifications. At the present time however, since there were already provincial sanitary establishments in existence, it was quite feasible and practicable to send young officers to England to be trained in sanitary engineering, and junior Assistants to the Sanitary Engineers might be recruited from among men who had had the requisite special training in England.

4,779. Under his scheme Inspectors of Works would, 50 years hence, be recruited from among the general professional class in the employ of district boards, municipalities and those in private practice. Hence he contemplated their entire recruitment in India ultimately. The question of their immediate recruitment however

was rather a difficult problem, and it was preferable that they should in the first instance be recruited from England. The status of the appointment of an Inspector of Works should be one that was about half way between that of a Superintending Engineer and an Executive Engineer, and the salary that should be attached to such a post might be one ranging from Rs. 1,250 to Rs. 1,800, i.e., the pay of a senior Executive or junior Superintending Engineer. There was nothing in his scheme which prevented a young Englishman from coming out to India and setting up in the same way as a barrister set up in private practice, either as a hydraulic electrical engineer, sanitary engineer or as an architect.

4,780. It would improve and expedite work if each provincial government had a separate trained quantity surveyor attached to their Architectural Branch. He had observed from a study of the syllabus followed in the several engineering colleges in India that the instruction given in estimating was not on English lines and that it in fact was entirely on incorrect lines. He mentioned in this connection that for the buildings in Delhi that had been designed by Messrs. Lutyens and Baker, the services of a trained quantity surveyor had been utilized, as the ordinary computer available in the country was quite unable to work on the designs of these Architects. Indian computers were only able to work on similar designs under the guidance of a trained Assistant, and if the work required of them was in no way mental but merely mechanical. They were drawn from a class which could only think in two dimensions, whereas it was essential for an effective computer to be able to think in three dimensions. It was the absence of this latter attainment that constituted the real difficulty experienced with the class of computers available in India.

4,781. In respect to the suggestion put forward in evidence by several Architects that it was desirable to recruit clerks of works in England for the subordinate staff of the provincial Architectural Branches, he remarked that he had consulted Mr. Baker, one of the Delhi Architects, about clerks of works and that that officer had informed him that a particular clerk of works whose services he had utilized on a certain work in South Africa had been paid £900 a year. He was informed that the class contemplated for India were men on about Rs. 300 to Rs. 500 a month, but he did not think it was necessary to give effect to the suggestion. He advocated, as an alternative, the recruitment of really capable English building foremen for the training of Indian craftsmen, on the ground that it was desirable to bring indigenous craftsmen up to the level of efficiency attained by similar individuals in England. The material from which clerks of works might be drawn in India was not at present good and required training and development.

4,782. With regard to a further suggestion that English master craftsmen, e.g., master brick-layers and master printers, might be recruited because of the present undeveloped stage of the building trades in India, he pointed out that the proposal if adopted would increase the cost of buildings considerably and remarked that the question to be considered was whether the country could, or could not afford to meet the extra expense that would be involved. The suggestion in effect amounted to a raising of the standard of buildings, and if this were introduced gradually *pari passu* with the expansion of revenue and expenditure on works there was a great deal to be said in favour of it. The greatest failing which he had noticed in Indian craftsmen was inaccuracy. The English foreman in charge of the stone-work at Delhi had informed him that certain of the craftsmen were just as efficient with their tools and in producing a finished surface as the ordinary workmen in England, but that they were generally not sufficiently accurate as regards setting out, etc. They had not been trained to consider absolute accuracy up to a sixteenth or a thirty-second of an inch and this was really essential for the production of first-class work. There was, however, no doubt that if the necessity for accuracy were impressed on Indian craftsmen for a sufficiently lengthy period that they would imbibe this fact and adhere to it. No urgent

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necessity existed for the importation of English craftsmen but their recruitment would undoubtedly be advantageous if the expense could be afforded.

4,783. His attention was drawn to the fact that though he had suggested in his written statement that the powers of technical sanction at present possessed by Executive and Superintending Engineers might be increased, he had not specified definite limits, and he was informed of the several proposals that had been put forward in evidence in this connection. He remarked that assuming that Superintending Engineers were appointed by direct selection, there was no reason why the powers of technical sanction of such officers might not be raised to as much as Rs. 2 or Rs. 3 lakhs, since the present limit of Rs. 50,000 was purely an arbitrary one. Similar powers up to Rs. 25,000 might, he added, be given to Executive Engineers, but only to those who were considered fit to exercise them. Every Executive Engineer, in his opinion, was not fit to exercise the same powers.

4,784. In respect to the recommendation in his written statement that the percentage at present allowed for contingencies and unforeseen items on an estimate might be increased from the standard of 5 to one of 15 per cent., he drew attention to the wording of his statement and explained that he had referred therein to the preliminary stages of an estimate and not to the detailed stages. Officers were in his opinion quite capable of working to within the 5 per cent. allowed for ordinary contingencies in a detailed estimate.

4,785. The fact that neither Executive nor Superintending Engineers were empowered either to dismiss or even punish lower subordinates was confirmed by him, and he added that such officers were only permitted to suspend and report members of their respective staffs. There was no objection to Executive Engineers being empowered to dismiss lower subordinates provided the latter had a right of appeal, and similarly to Superintending Engineers being given the power to dismiss upper subordinates, subject to a right of appeal to the Chief Engineer.

4,786. He suggested that Executive Engineers might be given greater latitude in carrying out their works and liberty to reappropriate funds from one work to another. He did not think such officers, as had been contended in evidence, would in the event of the acceptance of such a scheme be likely to shirk difficult pieces of work during construction and to spend funds on works that were more easily carried out, as Superintending Engineers would soon put a stop to such a practice. The contention that Executive Engineers might abuse the privilege by consulting only their own wishes in regard to the respective urgency of each of their works, with the result that funds might be appropriated from a work which a particular administrative department considered urgent to another which was not considered in any way urgent, could similarly be met by the fact that an efficient Superintending Engineer would soon ascertain the existence of such a tendency and put a stop to it. Besides, Executive Engineers did not decide the order of urgency in respect to works in progress.

4,787. The suggestion that allotments to Executive Engineers might be dispensed with altogether in order to obviate lapses and that such officers might be permitted to incur expenditure on their listed works against allotments made to their Superintending Engineers for all the works in each circle, was put to him. He replied that under such a system Superintending Engineers might, in the administration of their circles, experience great difficulty from a business point of view in deciding what funds were needed without some statement showing the progress on the several works in the circle. Executive Engineers should therefore furnish their Superintending Engineers with information as to the amounts they were likely to spend during the ensuing year. A monthly statement of all works in progress with the up-to-date expenditure incurred on each would not meet the case, and since the idea was to obviate lapses the desired result might be achieved by the following alternative method. If figures were worked out it would be found that

the percentage of lapses occurring yearly in each province was a fairly constant one, and all that was needed was to over-allot on works amounts up to such a percentage. He was positive that the result of such a practice would be a reduction in lapses. The system of over-allotting to the extent of the average percentage of several lapses was, he explained, working on a minus reserve, the total of which was equivalent to the average lapses. Hence he approved of an allotment for each work, with the delegation of power to Executive Engineers to reappropriate funds from one work to another, rather than allotments to Superintending Engineers alone, and added that as long as an officer had power to transfer funds the results should prove satisfactory.

4,788. He agreed generally with the contention of several Executive Engineers that a great deal of their time was absorbed by the maintenance of sub-heads of account for works exceeding Rs. 5,000 in value and that such amount was much too small a sum to fix for the purpose. A more vital point to consider in this connection was, however, the definition of a sub-head. The term was at present applied to every separate item of work worth not less than Rs. 500. He agreed that that limit might be raised to Rs. 1,000, but suggested that it might be varied according to the class of work concerned. For instance, it had been considered desirable to know the cost of certain classes of stone-work used on the large central buildings at Delhi, and it had been found possible to ascertain this only by noting under various heads the different rates charged. Hence, since certain items might occur which might involve sums of less than Rs. 1,000 and which it might still be important to have information of, it was very difficult to fix a definite limit for sub-heads. He agreed, however, to a suggestion that no sub-head need be maintained for an item worth less than Rs. 3,000 unless a special order to the contrary were received from the Executive Engineer concerned.

4,789. Contradictory evidence regarding the utility of the compilation of the monthly accounts in divisional offices was next put to him. He mentioned that a system of pro-audit had been instituted in Delhi, where work was concentrated under which his Executive Engineers, were not expected to maintain works abstracts and registers of works. These were compiled in the audit office and wherever such a practice was possible it could be followed with advantage. It was not possible, however, to introduce the system in the case of scattered works in districts. The present system of compilation could be very much simplified and an adequate amount of audit control retained, but it ought to be known to Executive Engineers how the accounts of their several works stood, since it was not feasible for an Executive Engineer to handle his works satisfactorily without being in possession of this information. The system of pro-audit followed in Delhi was the one which should be adopted in all cases of concentrated works. It was true that the system was not capable of much expansion, but in the case of a large concentrated work such as the headworks of a large canal or large bridge and possibly in presidency towns an audit office could advantageously be established to undertake the accounts work and this had been done in the case of the Sara bridge.

4,790. In respect to the contention that the rule dealing with the promotion of Assistant Engineers to executive rank should be abrogated in favour of promotion purely by merit, on the ground that it was believed merit had a stimulating effect and that selection was a better system from the point of view of the public service, he remarked that officers were not given an opportunity sufficiently early in their service of showing what they were really worth, and that under a system of selection a man who had not had the opportunity might be superseded by one who had had the opportunity. He also thought that under a system of selection there was a danger of having two standards, since recruitment to the Department was at present made from two sources in that there were both European and Indian-recruited engineers. He therefore considered it preferable to promote by seniority an Assistant Engineer to the rank of Executive Engineer if he was considered qualified for the post rather

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than to decide such promotion on the principle of selection. In his opinion capable men were more likely to be prevailed upon to come out to India if they knew that it was possible for them to rise eventually to a definite status and to earn a definite sum provided they performed their duties satisfactorily; the safeguard in the case of such a system was the power to deprive a man who proved himself to be an inefficient of the rank of Executive Engineer. Hence he advocated that the present rule should be retained and enforced more strictly than had been done in the past. He considered however that promotions above the rank of Executive Engineer, i.e., to the Superintending Engineer grade, should be made solely by selection.

4,791. On being informed of the representations made in evidence that the lower subordinate staff of the Public Works Department was inadequately remunerated at present in that the salaries paid to that staff hardly constituted a reasonable living wage and were insufficient to ensure honesty among the several members, and also of the suggestions that this staff might either be abolished altogether, recruited at a higher level as one service with the upper subordinate staff, or, if this was not possible that their salaries might be substantially increased, he remarked that the ultimate aim should be to secure in the place of the lower subordinate staff men of the type of foremen of works in England, and that for such a purpose the pay at present offered to lower subordinates was insufficient. On the other hand, the pay that the upper superordinates were permitted to reach ultimately compared favourably with that of persons of a corresponding class in England. For instance, if the pay of foremen holding responsible positions in the dockyards in England were taken into consideration it would be seen that upper subordinates in India holding somewhat similar positions were not inadequately remunerated. The lower grades of the present subordinate service were, he added, most in need of improvement.

4,792. There was no objection to the recruitment to the lower subordinate grades, in addition to the present class of lower subordinates recruited to the Department, of practical craftsmen of the *mistri* type and such a practice would effect improvement.

4,793. The posts of Superintending Engineers were worth retaining as such officers performed useful functions in the Public Works Department at the present time. He did not agree with the contention that the scrutiny of designs and estimates could be undertaken efficiently by Executive Engineers and that inspections by Superintending Engineers were not of very great material value. On the other hand, a reorganization of the Department, by enhancing the powers of Executive Engineers and delegating to such officers more responsibility while giving them better pay, with a view to dispensing with Superintending Engineers, would result in overburdening the central office of the Department. It was true that the amount of such extra burden would depend to a certain extent on the extent of the powers delegated to Executive Engineers, but under the present arrangement the Chief Engineer was already very much overburdened and had not the leisure to perform many of the functions he was required to attend to.

4,794. Provided too much work was not thrown upon one office, centralization of designing work was sound in principle. It would not be practicable, however, to give effect to the suggestion put forward in evidence that a central designing office should be established in each province to which designs might be sent for the framing of detailed plans and estimates after the preparation of the stage I plan and estimate by the executive staffs in districts. On the contrary, there should be several such offices distributed over each province as it was desirable that designs should reach the Chief Engineer in a more finished form than that of the earlier stages, and the departmental machine would clog if designing work were too centralized. Each designing office should be practically what the present Superintending Engineer's office was and the Superintending Engineer should request the several Executive Engineers in the circle to submit proposals in connection with schemes, but the method of

the working out of the schemes in detail should be left in each case to the head of the circle to decide. If that officer had an Executive Engineer subordinate to him who was a keen and capable officer, he might request the latter to prepare the project in detail in conjunction with his executive duties or invite him to the circle office for the purpose. To the contention that it was not possible in practice to call a divisional officer away from his division without providing a substitute, he replied that if such an Executive Engineer had a suitable staff of sub-divisional officers that difficulty would not arise. He desired to establish a central designing office where designs could, whenever possible, be prepared in close collaboration with the Executive Engineers concerned, as a large amount of time was at present wasted by designs being prepared in complete detail by the Executive Engineer and submitted subsequently to the Superintending Engineer. In short, he advocated the establishment of central designing offices, but desired at the same time that Executive Engineers should undertake detailed designing work in those offices.

4,795. If he were allowed to choose between one year and two years as the period during which engineering students should receive a course of practical training, he would select two years, though he personally considered that 18 to 20 months, i.e., two working seasons, would be found to be sufficient. Practical training meant more than the mere mixing of mortar and the laying of bricks and it should include a training in designing. To achieve this and it was therefore desirable that a portion of the period of such training should be spent by the student in a designing office. In effect training on works and in a designing office should be intermingled and the student should be desired, whenever possible, to undertake the entire responsibility for a small work. By a small work he did not necessarily mean a complete small building, such as a police station or a constable's hut, but rather a portion of a large work, e.g., one of the numerous independent small works connected with a canal scheme or with a large building scheme like the Delhi project.

4,796. A course of practical training should be afforded to all students irrespective of whether they ultimately entered government employ or not. It was quite possible, provided a special officer were appointed to train the students, for the Public Works Department, with such supplementary assistance as they might receive from port trusts, large municipalities, etc., to provide such a training, and there would at all times be ample works in progress for the purpose. He suggested the appointment of a supervisor over the students, as it would frequently be impossible for the Executive Engineer concerned to watch what particular students might be doing. He personally did not think the work of this supervisor would clash with that of the divisional officer.

4,797. Subsistence allowances should be given to students while under practical training. He suggested as a reasonable stipend the payment of an amount which was considered sufficient to meet the needs of a single man. The payment of premia by students for their practical course of instruction was out of the question under present conditions in India.

4,798. (Sir Noel Kershaw.) By his previous statement that the Superintending Engineer at the present time performed useful functions, he did not mean to imply that perhaps 50 years subsequent to the introduction of his suggested scheme this would necessarily be the case, since the scheme did not contemplate the existence of Superintending Engineers 50 years hence.

4,799. In recommending that discrimination should be exercised in the delegation of powers of technical sanction to Executive Engineers, as the capacity of the several Executive Engineers varied and it was quite possible to delegate to some of them higher powers than to others, he did not mean to imply that there were individuals holding the rank of Executive Engineer who in reality should not have been placed in that position. It was generally correct to assume that the several members of the service in the Executive Engineer grades were competent to be there and that an incompetent

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Executive Engineer would constitute an exception to the general rule.

4,800. It could only be judged whether the English foreman at present employed at Delhi had had an educational effect on the work in that city or not after the work was finished. He was not sure how long this particular foreman had been employed in Delhi, but remarked that he had been employed for a longer period than six months. The services of this foreman were not utilized in an educational capacity. It had not been thought necessary to shift him from one portion of a work to another in order to see the effect of his instruction. The educational value of this officer really lay in his influence on construction and the witness thought that this foreman had, since his arrival in Delhi, improved the class of work executed there.

4,801. He confirmed his previous suggestion that if his scheme were given effect to, Inspectors of local works should be recruited from England for perhaps the next 30 years. It was quite conceivable that there might in future be engineers who had served on the staffs of district boards for perhaps about 10 or 15 years who would be competent to undertake the duties of these Inspectors, but when he made his statement regarding the recruitment of these officers he had considered rather the present number of individuals in district board service who were competent to undertake the duties of these Inspectors. He knew however of a fair number of district board and municipal engineers who were really first-class men and to whom preference over men recruited from England should be given.

4,802. Architects willing to design contribution works for private bodies might be obtained on payment of the ordinary scale of fees paid at present to similar individuals in England, and he did not think that his scheme for the transfer of contribution works of private bodies to private agency would be prejudiced by the fact that the expenses of these bodies would be somewhat increased. Such increase would not constitute a very large addition and it was quite possible to secure Architects to design the schemes in question for the fees recommended by the leading institutes in England. The case of Delhi was exceptional as Messrs. Baker and Lutyens, the Architects engaged for Delhi, were men who had practices in England which were likely to be damaged by their accepting work in this country. Hence they were allowed a higher scale of fees by the Secretary of State. The fact that these two Architects had accepted the Delhi work might, however, after the work was over, have the effect of increasing their reputation.

4,803. Messrs. Baker and Lutyens were paid a fee of 1½ per cent. for their preliminary sketches. This percentage amounted to Rs. 1,250 on Rs. 1 lakh. Hence if a work worth this amount was a contribution work belonging to a private body the actual amount that that body would receive from government towards this would usually be Rs. 625. Consequently, the additional expense that would be involved by the employment of an architect to design a work costing Rs. 1 lakh on behalf of a private body would be the same viz., Rs. 625.

4,804. (Rai Bahadur Ganga Ram.) The percentage allowed by government on the capital cost of buildings for repair work varied in the several provinces. During his service he had never been in a position to calculate this percentage for the Madras Presidency. If his recommendation were given effect to and repair work were transferred from the Public Works Department to the several departments which occupied government buildings, allotments for repairs should be made on the basis of the percentage in each of the various provinces. For instance, for Madras a percentage based on the actuals with the addition of a small percentage over and above should be fixed. Government spent more on repairs than private landlords, but he had known of instances where *kutcheris* originally worth about Rs. 1 lakh had amounts as low as Rs. 300 allotted by government for repairs.

4,805. The plans for such contribution works as might under his scheme be transferred to private agency should

be submitted to the Public Works Department in both the preliminary and final detailed stages. He recommended in this connection that when a preliminary stage plan was submitted to the Public Works Department that that agency should only inspect it with a view to ascertaining any *prima facie* objections from the government point of view and also whether the approximate figure shown as the cost of the scheme was reasonable or not. When however the plan was submitted a second time for final approval of the detailed plans and estimate rather more scrutiny should be exercised. Since it was part of the administrative duty of the Public Works Department to scrutinise plans and estimates, he did not consider that that agency should receive fees for such work, even though their percentage establishment charges might be effected thereby.

4,806. He enumerated several Indian contractors who had been engaged for the works under his charge at Delhi. A particular European firm established in Calcutta was once requested to tender for a portion of one of the Delhi works, but they declined to comply with the request. All tenders received for works in Delhi were not submitted to him for final approval, and those that were sent to him reached him in tabulated form. He was not aware whether the European firm in question had submitted a tender which was 30 per cent. higher than those received from the other applicants.

4,807. The Architects employed on the Delhi works were paid their fees on a percentage basis and not by means of a monthly lump sum. He was unable to state whether, as had been contended in evidence, it was more economical for government to employ whole-time Architects rather than such individuals on a percentage basis.

4,808. Executive Engineers should in certain circumstances be given full powers in respect of storage charges and not be restricted to the limit of 10 per cent. at present fixed for storage charges, which limit could only be waived by the local Government.

4,809. The designing work of an Executive Engineer was the most interesting portion of such an officer's profession.

4,810. Under his scheme for the employment of specialists in each province for sanitary, architectural and electrical work, he contemplated that after professional approval of, say, the outlines of a sanitary scheme had been obtained from the Director of Works the detailed technical sanction should be left to the provincial Sanitary Engineer. Similarly, in architectural and electrical work the details should be left to the provincial Architect or provincial Electrical Engineer as the case might be, since it was not necessary to throw upon the Director of Works the necessity of according detailed sanction. It was not necessary to appoint, over the several provincial Sanitary Engineers, an officer who might be designated a Sanitary Engineer General.

4,811. (Mr. Mackenzie.) The question of the affiliation of engineering colleges in India to universities had never been studied by him from any one point of view, but at the time when he held the post of Principal of the Engineering College in Madras the syllabus of that institution had been actually in advance of that of the university to which it was affiliated. For instance, under the college syllabus it was permissible to set a question on an internal combustion engine, which was not the case under the university syllabus. This matter had, however, been put right, but it was quite conceivable that such a position as had obtained in the past might arise again. It should be made a condition of affiliation to a university that a practical course of training should form part of the course for the B.E. degree and that the actual marks given to students for their practical work should count towards their degree. A large proportion of the marks necessary for a diploma need not, however, be allotted for the practical training portion of the course, but each student should be required to secure a certain proportion of such marks before the diploma was granted to him. Marks for practical work should be allotted by the officer appointed to train the students. A university examiner for the degree examination would be necessary and he agreed that that post could be filled

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by a member of the college staff, but considered that the practical work should not be included in that officer's scope, since it was desirable to secure for such work the services of an officer from outside the college. The university should take care to be elastic in their regulations and in the constitution of their Faculty of Engineering, the members of which should be working engineers.

4,812. A training in surveying and estimating was absolutely essential to an engineer and it was not wise to reduce, as had been contended in evidence, the instruction furnished at the Roorkee College in those two subjects on the ground that they were not of educational value. Estimating had considerable educative value, but it was not necessary to train an engineer in surveying above the equivalent training in England.

4,813. The possibility of dispensing with the India Office by appointing a buyer at each provincial headquarters, either to purchase stores for all officers, or to supervise indents and instruct officers where to purchase specific articles, depended on the nature of the operations in each province. It was a little difficult to obtain such information in Delhi and he was the only officer who effected purchases there, but such was not the case in other places. The ordinary *majumdar* Executive Engineer would undoubtedly find a centrally situated buyer or advisor located in a presidency town of great use and assistance. Such an officer might be located at Bombay for the Bombay Presidency, at Madras for the Madras Presidency and at Calcutta for Upper India and Bengal.

4,814. The rules regarding the purchase of stores of European manufacture restricted officers of the Public Works Department very considerably. Though it was possible to purchase almost anything through a contractor or there were certain local orders that had been issued in regard to the purchase of stores which frequently interfered with this power, and he had known contractors who had purchased inferior articles. He recommended that purchases from the representatives of firms in this country, but not from agents, should be encouraged,

as it was desirable to encourage manufacturers in England to establish branches in India and at the same time to encourage indigenous industries; also that unrestricted purchases might be made from branches of firms established in India. It was true that such branches would generally be English branches, but Indian firms which dealt in similar articles usually manufactured them in the country in some instances at a cheaper rate than it was possible to procure them from England. Articles of indigenous manufacture might not be up to the quality of English manufactured articles, but they might suffice for the purpose for which they were required and it was preferable in such cases to encourage the purchase of indigenous articles.

4,815. (Mr. Cobb.) To check the tendency of departments wasting the time of the Public Works Department unnecessarily in the preparation of plans and estimates for schemes that never materialized, he recommended that the responsible departments should in such cases be debited with the expenditure entailed by unnecessary preparation, irrespective of whether a preliminary or detailed scheme were concerned.

4,816. Government workshops should be dispensed with in places where government were sure of securing unrestricted competition but in the absence of such competition the abolition of a government workshop introduced the danger of falling into the hands of monopolists.

4,817. Executive Engineers who proved themselves inefficient should be compulsorily retired from the service, but promotion from assistant to executive rank should be regulated by seniority. Revised rules regarding compulsory retirements had recently been promulgated and though such action required the sanction of the Secretary of State it really depended on the courage of the persons responsible to enforce them. Since he anticipated that on the whole better results would accrue from the retention of the present arrangement, he did not desire to recommend the enforcement of the principle of selection for appointments lower than those of Superintending Engineers.

J. BEGG, Esq., F.R.I.B.A., Consulting Architect to the Government of India.

Written Statement.

4,818. So far as building is concerned the object of the present inquiry is to devise measures that will presumably have the effect of bringing the practice of the Public Works Department gradually into line with that under which government work (as well as private work) is carried out at home. Such measures should tend to secure for government some of the advantages as to economy and efficiency of the home system. Incidentally they should also give a fillip to the building industries by placing these on a more independent and better organized basis. They should also tend to the growth of the private professions of architect and engineer in India.

4,819. Among all the respects in which Indian building practice, as instituted and supported by government, differs from home practice it may not be immediately recognized that there is none so fundamental and far-reaching as is shown by the anomalous position under the former of the architect with relation to his work. In India that position is as in no other civilized country in the world. Here the architect, being still something of a rarity, is regarded as a "specialist." He is not, as at home, the complete architect, but merely an expert adviser in design without direct responsibility over the work. As a "specialist" he is given special treatment—in most cases, however, not specially good. (But this Committee is not primarily concerned with personal grievances, so that point must pass.) The architect's responsibility does not extend even to his designs, as to which it is clearly stated that the sole responsibility rests with engineers, ultimately with the Chief Engineer of the province in which the work is to be erected.

4,820. This state of things is most unsatisfactory to the architect. I wish to shew, and shall attempt to do so later, that it is also unsatisfactory in the interests of gov-

ernment and in those of the country generally. Meanwhile my point is that no approach to home conditions in building can be expected till this anomaly is wholly or partially removed. In other words, if the system of the Public Works Department is to be altered even slightly towards home conditions in other respects, but not in this respect also, we shall be embarking on an experiment for the result of which we have no precedent to guide us. The view I wish to press on the Committee is this, that whatever modifications of the present system are initiated now should be such as to lead ultimately to as close an approximation to the home system as will secure to us the full advantage of home experience.

4,821. There has been no reason at all for the feature of the Indian system to which I allude except temporary expediency. It presented the easiest way of grafting the services of the architect on to the original system of the Department without modification of existing conditions—without, in fact, any such changes as may ultimately be the outcome of the present inquiry, and such as could not have been attempted without a similar inquiry. The first rough grafting may be said to have taken place in the beginning of 1901, when I was brought out as Consulting Architect to the Government of Bombay. In sixteen years, in spite of the makeshift nature of the grafting, the one shoot has grown to over twenty—a proof in itself of the vital advantages of the presence of the architect. The architect, in fact, has proved his worth.

4,822. The one and only modification of the Public Works Department system—a purely local one—which has hitherto been attempted in recognition of the advent of the architect, was made, largely at my instigation, in Bombay in 1901. While still retaining my advisory relation to all other buildings, I was then given executive

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charge of the building of the new general post office and of other works of my own designing in the presidency town. It cannot be pretended that the modification has not been a success. The "sub-division" with which I began in 1904 is now found expanded into a "district" or "division" (as it would be called elsewhere in India) in charge of an Executive Engineer under the control of the Consulting Architect. This "district" is responsible for some of the best building work which has been carried out in India during recent years. It is a curious instance of our national reluctance to learn by experience that the example of Bombay has not been followed in any other province.

4,823. I shall now attempt briefly to state the advantages to be looked for from such a possible modification of the system of the Buildings Branch as would lead to the ultimate employment of architects wholly as architects, and not merely partially as "specialists in design" — or draughtsmen. I shall group these advantages thus: (a) efficiency; (b) economy; (c) good effect on the building industries; (d) progress in architecture; (e) good effect on the profession. Most of the advantages, however, under each group have a way of applying under others as well.

(a). *Efficiency.* Better work, because of the greater directness of touch between architect and workmen. The architect now finds it impossible to maintain any effective touch with the work. Under present conditions he is placed as a violinist would be who might be compelled to play in gloves. To use an electrical simile, the architect represents the "generating station" for all ideas and instructions on the building. To insert between that and the work an independent control owing no allegiance or responsibility to the architect is equivalent to interposing so much "resistance," with a correspondingly reducing effect on the resultant efficiency. The system leads to frequent unseemly recriminations between architects and executive. It is, in short, so fraught with possibilities of misunderstanding and friction that the exercise of the greatest tact (not always present in men keen on the professional aspects of their work) is necessary on both sides to secure any semblance of smooth working.

(b). *Economy.* The architect's particular attitude towards his work, induced both by training and by natural inclination, but most of all by the fact that he, as the designer, has a keener interest in the work than any one else, brings about a better understanding with workmen, no matter of what nationality, than is possible with independent control. The entire machine therefore runs with greater smoothness thus tending both to efficiency and to economy, the latter in ways hardly necessary to enumerate. For instance, this understanding makes it easier for the works controller to infect all beneath him with his own spirit of integrity, as well as to discover and check any irregularities that may arise. It tends to the elimination of the "rotter" in every capacity, whether as workman or supervisor, from the works, where, indeed, it does not galvanize him into better ways. It gives everyone on the works a better chance of "running straight." At least it can be said that the present system, with all its tangle of rules and all its costly and elaborate scheme of accounting, does not stop leakages. Architect control at its worst could not possibly be less efficient in this respect.

Then there is the enormous duplication of work. I can testify that when I obtained executive control of my own work in Bombay I found that it took me hardly more of my own time and labour than it had done previously to convey my ideas and details through the machinery of the Executive Engineer's office. It led, too, to a considerable reduction in the amount of detailed drawing necessary.

Again it is seldom realized how much of the work of the architect in India consists in re-doing projects already elaborated in detail by someone else. In some cases engineers have been employed to recast projects already prepared by an architect. This absurd state of things is responsible for much lost labour and wasted expenditure.

I may further allude to the many instances in my own experience where the expense has had to be incurred of pulling down and altering work owing to imperfect understanding of the architect's intentions on the part of the executive officer, and in some cases to wilful departure from these. This would all have been saved had the architect been in direct control, and not merely in the position of an adviser.

We have then the question of the quality of work. Would architect controlled work be as good? As an expert in building I have no hesitation in saying it would be even better. It would not be hard to bring forward instances to prove this statement. The great improvement which recent years have seen in bricks and brickwork generally in India, is mostly due to the advice and criticism of the architect. I can point to two examples in Bombay of stone-work walling, costing the same and carried out to the same specification. In the one case the work was supervised by the Executive Engineer's office, in the other by the architect direct. Yet little more than a glance is sufficient to show the superiority of the latter.

On the whole I am convinced that the complete employment of the architect renders possible a more economical system of work control than under government's system with partial employment of the architect.

(c). *Good effect on the building industries.* We architects have proved to our own satisfaction at any rate that the Indian workman can, if properly handled, produce practically equal work both in quality and in quantity to that which the British workman can. I am aware that this is contrary to the prevailing opinion, but I make the statement in all seriousness. Architects are confident that by fostering an interest in and a fondness for the work itself in the workman (as is possible only when the control is in the hands of men with the particular point of view towards work which the architects has) a better spirit all round can be instilled into the trades to the lasting benefit of the men, the trades and the work. The best work is not being got out of the men at present. The building crafts of India, slowly dying under existing conditions, would begin to revive. The country could have conferred on it no greater benefit than this. Even without trades unions the spirit in the building trades is not good. The men already show their interest in their pay to be greater than their interest in their work. This I suggest to be largely due to the point of view of their present controllers who, however skilled, lack the keenness of interest in the work possible only to the designer, being such that it does not fully qualify these to inspire the attitude of interest in the work for the work's sake. With any extension of the contract system, such as is bound to come sooner or later, this is likely to become aggravated. What the spirit would become with the introduction of trades unions (quite a likely concomitant to such extension), one shudders to think. The architect's is almost the only mitigating influence in England against the bad effects of trades unionism in the building trades.

(d). *Progress in architecture.* With architectural design looked on as a speciality in the hands of others than those who guide execution, progress in architecture, so greatly needed in India, is severely handicapped. Design and execution go hand in hand and are so sensitively interdependent that the one function cannot properly be exercised without the other. Consequently a man who is compelled to specialize in design alone can hardly help losing his command of ideas and his power of design. His designing loses its vital relation to actualities, its touch with material and with the appropriate and economical use of it. On the other hand if and as he exercises the function of construction, so his powers of design go on improving. The converse also is true. The man who does not practice both functions is not entirely fit to be entrusted with either.

(e). *Good effect on the profession.* On the architectural profession the effect would be to stimulate the growth in India of a private profession which is now practically non-existent, except for a very few firms in Calcutta, Bombay, Rangoon, etc. Private enterprise in the

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profession is so restricted that difficulty, amounting to impossibility, in proportion to the distance from these centres, is now experienced by all promoters of building projects desiring to find an architect to undertake their work. The modern Indian communities, in spite of the great architectural traditions of the country's past history, have hardly taken to the profession at all, for the obvious reason that government's attitude towards it makes it appear as an unnecessary luxury. Government itself showed an example of doing without the architect for generations. By this time the public has been taught to look to the engineer for all expert advice on building, to the architect merely for the "trimmings" on the exterior elevation! It is mainly this attitude on the part of the Indian public, taking what it conceives to be its due from government (as it always will) and taking no account of the reasons which led to government's attitude, which effectually stops the way to the profession growing, becoming popular and providing, as it is well calculated to do, careers for a large section of the educated community of the country. It is to this that is due the deplorably low state of public knowledge and taste in building in India, as well as (to a certain extent) the low state of honesty in the building trades.

Again if the present "specialist" treatment of the architect is not amended the high class of men who have hitherto sought employment under government will not continue to do so. Already government employment in India is beginning to have a very sinister reputation in the profession.

4,824. The above is a categorical statement of some of the advantages to be looked for from a proper recognition of the architect by government. Speaking generally the advantage of having architects to do architects' work would appear to be self-evident enough to need no categorical statement did one not know one's India. In discussing this matter, I have often found that objections have a way of resolving themselves to one. I am apt to be told (not, let it be understood, by engineers) that I am attacking the vested interests of the engineers. Surely this is not so. If it could be shown that the present generation of engineers have vested interests in the control of building operations it might even be one's duty to attack these. But can it be so shown? We are, however, looking to the future, when engineers yet unborn will be in India. How can these have acquired a vested interest in any portion of the legitimate work of architects?

4,825. Again I am sometimes told that it is necessary to have a surplus of engineers, and that it is necessary to employ these by retaining in their hands such work as they can manage in building. This, I am told, is because of the supreme importance of engineering work to the country in comparison to building work. No doubt engineering is of supreme importance to countries which have not reached a certain stage in their development, and whose chief needs are railways, canals, harbours, etc. But I submit that India, certainly so far as the major provinces and all the towns are concerned, has now reached a stage at which architecture, or shall we say building, is at least as important to its welfare as the sterner and more pioneering works of the engineer. Or, if it has not yet done so, at least it must be seen that the perpetuation of a system that sacrifices building and the gentler arts to engineering puts a gratuitous brake on the country's progress towards that stage which might now well be removed.

4,826. Although, as I have admitted, this Committee is not primarily concerned with personal grievances, I cannot close without offering the suggestion that an inquiry into some of the more personal grounds of discontent on the part of the government architects might indicate measures conducing to the better working of the Buildings Branch. They feel that they are not accorded the treatment to which they are entitled as representatives of the profession primarily concerned with building, the chief work of the branch. Their small number and meagre recruitment in proportion to the amount of work to be dealt with as well as to the more copious recruitment to the branch of engineers; their temporary

and unpensioned terms of service, and the absence of means of giving them the promotion that is such an incentive to their engineer colleagues; the position of subordination to the engineer which these things, as well as the general organization of the Department, connote, in spite of the fact that it is *their* professional work, and not engineers' work, with which the branch, as a whole, has chiefly to do, all these circumstances have effects mutually interacting socially and professionally, and bearing on them as individuals, tending to embitter their outlook and to prejudice their relations both with their colleagues in government service and with government itself.

APPENDIX.

In the event of the acceptance of the central principle for which I contend in the foregoing memorandum, namely that the architect, as designer of the project, is the proper person to whom to entrust the control of and responsibility for execution, it will be desired to examine the measures to that end which I would suggest. The central principle accepted, and given a determination to give effect to it whenever possible, such measures would not be hard to devise. It is harder to think out suitable measures while the main principle of my contention is still unaccepted. It will, however, be useful to make the attempt subject to the proviso that, while the central principle admits of no modification, the measures outlined are put forward as no more than tentative suggestions to form a basis for discussion.

OUTLINE OF SUGGESTED MEASURES.

I. GENERAL.

(a). *The Architect's control of executive work.*—It is necessary to explain that for the architect to have adequate control of, and touch with, work it is not essential that he should actually in his own person perform the functions at present exercised by the "Executive Engineer." In a department it is necessary only that he should be placed somewhere in the direct line of authority between government on the one hand and the actual work itself on the other, instead of being placed, as at present, outside, and on one side, as it were, of that line in the capacity merely of adviser and, in a very limited degree, of critic. My point is that it is to the latter position of the architect that is to be attributed his present want of touch, his comparative ineffectiveness, the bad economy of his employment and much of the lost labour and duplication of work at present found in the branch. If, however, he were placed in the direct line of control, both his responsibility for the project as a whole (for design as well as execution), and the responsibility of the executive to him, and through him to government, would be direct, uninterrupted and assured. Such a position, while placing more responsibility on the architect, need impose on him no more work or call on his time. On the contrary, as I have already explained, it would render possible a considerable reduction in the amount of the detailed drawing and specifying which is now necessary to explain the intentions of his design properly.*

At the same time, it is most desirable to aim at a gradual but eventually a more or less complete, replacing of engineers by architects in charge of divisions and offices entrusted with the execution of building work, partly because the latter are better fitted to grasp the architect's intentions, and partly from the necessity of having feeder appointments for the senior posts, and of training, exercising and testing the men in their profession all round as it applies to India.

(b). *The Buildings and Roads Branch.*—Since buildings and roads do not group well together, the Buildings and Roads Branch might well cease to be as such. In

* In effect, under the present system, it is possible only in comparatively few cases to give the full amount of details and instructions necessary to explain the design.

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its place I suggest constituting a Buildings Branch and a General Engineering Branch. The Public Works Department would then consist of three branches, viz., (1) the Irrigation Branch, as now, (2) the General Branch, and (3) the Buildings Branch. Irrigation and General would be the engineers' sections: Buildings the architects' section. Further than that I see no need for, or feasibility of, sub-division. Electricity, roads, bridges, sanitation, water-works, mechanical engineering, etc., would all group conveniently in the General Branch, no matter how many technical specialists it were found expedient from time to time, and according to the needs of particular provinces, to employ. The branches would mutually assist one another where desired, architects with the design of bridges and dams for the General and Irrigation Branches, engineers with special engineering details for the Buildings Branch, etc.

(c). *Provincial Secretariat*.—A typical provincial Secretariat would then comprise, (a) a Chief Engineer for Irrigation, (b) a Chief Engineer, General Branch, and (c) a Chief Architect. The senior of these three would be also Secretary to Government, or the one whose branch represented the most important interests of the particular province. Each would control the work and establishment of his own branch. In certain cases it might be necessary to make two of them Secretaries to Government. In other cases one engineer and one architect might suffice—one of these being Secretary.

(d). *Government of India Secretariat*.—The Government of India Secretariat would remain practically as now. The Architect might remain, as now, an "attached officer," but he should be a Chief Architect, with status equal to that of a Chief Engineer. His position should, in short, be somewhat analogous to that of the Inspector General of Irrigation.

With the above slight modifications of the departmental constitution the touch of the architect of any province with construction works, and his control of these would be complete. As head of the Buildings Branch he would be a medium for the transmission of all responsibility and authority over works. The case of the Architect to the Government of India would be different. I propose to examine that later in a separate section of this note.

(e). *Applicability of measures*.—These measures would be immediately applicable. They would involve no dislocation to the existing system, nor hardship to anyone. In provinces where there is already an architect the necessary *personnel* exists for the purpose. It is true that many of our architects are somewhat lacking in experience and seniority, but these are matters as to which every year contributes its quota, while promotion in advance of actual seniority is hardly to be avoided in any service where numbers are so far below a true proportion to work as is the case of the architects' service at present. A younger man, acting in the capacity of Chief Architect, would naturally lean on his senior engineer colleagues. At the same time I do not think it would conflict with the scheme I am outlining if the provincial architect were in certain rare cases given the rank merely of Superintending Architect. The point should be decided on the relative importance to the province of its building work as well as on the relative seniority of the architect. But it would, I fear, conflict with my aims if the architect were given rank lower than that of Superintending Architect. Any administration whose building work were not of sufficient importance to justify the employment of an architect of Superintending rank at least should, I suggest, continue to depend on the services of the Government of India Architect.

(f). *Provincial sub-centres*.—I have already alluded to the desirability of the extended employment of architects being gradually brought about. This means that, in the major provinces, at any rate, it would be necessary to keep in view the establishment, as soon as work and number of men justified it, of two, three or more architectural sub-centres at suitable points in the province. These would be "divisions" (or "districts," as they would be called in Bombay) each in charge of an executive architect, and their duties would be to execute building

works within their own districts, and to design such of these, or such portions of these, as the Chief Architect might see fit to depute to them, all under the general superintendence of the Chief Architect at provincial headquarters. This would naturally be a measure of very gradual application. It would merely involve, in most cases, the taking over by architects of certain executive divisions, as these showed signs of becoming sufficiently important building centres, and as architects of due experience became available for the purpose. I regard this measure of prior importance to the replacing of the engineer by an architect in the headquarter or "presidency" division or district. The latter, being under the general supervision of the Chief Architect, and in closer touch with him (as in fact, is the "building district" in Bombay town now under the Consulting Architect there—the solitary example of architect control in India), would naturally be among the last in any province that need be taken over by an executive architect.

(g). *Recruitment of architects*.—The recruitment of young architects should be gradually increased. A corresponding decrease should also be made in the recruitment of young engineers till a just proportion between the two were eventually reached. The increase in architects need not necessarily be equal to the decrease in engineers, (unless for the reason of an increase of work), for, with the improved system, much overlapping of work would be avoided and economy of establishment made possible. The ultimate aim should be to officer the Buildings Branch entirely with architects, except for such engineers as might be temporarily attached to it for purposes such as dealing with special engineering details in buildings, reinforced concrete, etc.

(h). *Method of recruitment of Architects*.—The present method of recruitment of architects does not seem to call for modification. It will be time enough to reconsider the point when, and if, in the future Indians and the domiciled community show signs of taking to the profession to any extent, and if training colleges (on the lines of the architectural branch of the Bombay School of Art) are established to any extent throughout India. At present the few students in India who desire to complete their professional education invariably go home to sit for the Institute examinations, and thus have a full chance of sharing in home recruitment to the Indian service.

I think, however, that the probationary term under which men are brought out might with advantage be reduced to two years. This is long enough to test a man's capabilities. The customary five years is too long for government to keep an unsuitable man, and too long to enable a man who might not be remaining in India to resume his place in the home profession.

(i). *Permanent enrolment*.—On the completion of his probationary period every man who does not return home should automatically take his appropriate place on the general list of the Public Works Department on exactly similar conditions as to permanency of service, pay, allowances, pension, leave, language and professional examinations (the latter, however, only in the case of men who come in, as all will eventually, at the bottom) as do the engineers.

The architects should appear in the same lists with the engineers. I suggest dropping the terms "engineer" and "architect" from the grade and class headings of these lists. Assistant class, Executive class, Superintending class, Chief class, would answer all purposes. The letters E and A in the "remarks" column would obviate all confusion.

(j). *Code rules*.—A great deal of the work of the executive officer at present arises from the unduly meticulous nature of the rules in the Public Works Department Code, particularly with regard to accounts; a thorough overhaul of that Code as, say, by a departmental committee, would obviate the necessity for an increase in the recruitment of architects proportional to their executive work. To criticize the Code in detail would, I think, unduly inflate this note. I am in substantial agreement with most engineers with whom I have

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discussed the matter. I would advocate a further relaxing of the rules applying to "goods of European manufacture." These tend to discourage local trade enterprise. In the case of the innumerable articles—materials and fittings, etc., required in buildings, it would be an advantage if it were possible to a greater extent to select these after personal inspection by the designer of the project than that so much ordering on indent should be done.

II. THE CONSULTING ARCHITECT TO THE GOVERNMENT OF INDIA.

(1). *The Consulting Architect, Government of India's sphere.*—The foregoing remarks apply only to the architects in the Department generally, not to the case of the Consulting Architect to the Government of India. The position of the latter presents so many features to differentiate it from that of the provincial architects that in examining it I must do so at some length, and so devote a section of this paper entirely to the purpose.

The appointment has, from its initiation in 1902 till now, been more or less in a fluid condition. At first there were only three provincial architectural establishments in India, that at Bombay, that at Madras and that in Burma, the two latter being still in the hands of the "Engineer Architect," if I may call him so. The sphere of the Consulting Architect to the Government of India was therefore a wide one. Besides being the general adviser to the Government of India he was liable to be called upon to prepare designs for buildings in Bengal, the United Provinces, the Punjab and the Central Provinces, besides the North-West Frontier Province, Baluchistan, Assam and the Central India and Rajputana Agencies, etc. The rapidly increasing demand for designs made the situation a somewhat hopeless one and led to the successive establishment of architects first in Bengal, then, a few years after the "partition" in Eastern Bengal and Assam, then in the United Provinces and in the Punjab. On the closing of the office of Superintending Engineer Architect, Burma came into the sphere of the Consulting Architect to the Government of India for some years till the appointment of Consulting Architect to the Government of Burma was made in 1911. All these successive provincial appointments have led to corresponding devolutions from the sphere of the Consulting Architect to the Government of India which may now be said to consist, so far as designs are concerned, of the following:—

1. The Government of India's own buildings in Simla.
2. The Central Provinces.
3. North-West Frontier Province.
4. Assam.
5. Baluchistan.
6. Central India.
7. Rajputana.
8. Buildings required by the Military Works Department generally.
9. Buildings required by the Railway Department generally.
10. Occasional buildings by special request of Imperial departments.
11. Occasional buildings from miscellaneous sources.

None of these, with the exception of 1, 2 and 8 afford a very constant supply of work. The Central Provinces may before long have their own architect, and it may be assumed that in due time all territory in British India will be covered by the services of some architectural establishment other than that of the Consulting Architect to the Government of India. There will then remain to the latter office, 1, 6, 7, 8 and 9, at any rate, as sources of supply of work (10 and 11 may, I think, be regarded as personal to the present incumbent). There will also by that time be such work as is required within the imperial reservation at Delhi, extended, perhaps, to Simla.

(2). *Need of definition of his sphere.*—It will be seen from the above that though the general sphere of the Consulting Architect to the Government of India, in spite of successive devolutions, has hitherto afforded a very copious supply of original work in the aggregate,

it has nevertheless been so constantly changing that the supply has been subject to embarrassing fluctuations. In many respects too, especially of late years, the limits of the sphere have been seen to be somewhat ill-defined (as for instance where work has come to the Consulting Architect through reasons personal to the incumbent) and this has on certain occasions led to situations requiring some tact to avoid friction with local Consulting Architects. A considerable amount of work, too, is put through in what I have called the Consulting Architect, Government of India's "general sphere" without the services of any architect, owing to an imperfect understanding that his services were available. Altogether it is desirable that the sphere of the Consulting Architect to the Government of India should be more clearly defined.

(3). *His functions.*—It is necessary here to pause for a little to consider what the functions of the Consulting Architect to the Government of India are, or let me say should be. I may be allowed to remark that the Government of India themselves do not appear, so far, to have been able to make up their minds as to what exactly they have intended ultimately to make of their Consulting Architect, hence much of the difficulty of his present position. In my opinion his functions ought to be:—

(a). To advise the Imperial Government generally on all questions relating to architecture, buildings, appointments, professional education of architects, etc., and all such matters as to which they may require his advice.

(b). To assist in co-ordinating the various architectural centres and in securing for the country generally the advantages of progress in any one province; to keep government informed as to that progress; to serve as consultant to provincial governments and their architects on the more important projects and general architectural questions.

(c). To assist in safeguarding imperial interests, as distinct from provincial, in the matter of buildings, with special reference to economy and efficiency.

(d). To undertake the design of original works required by government within his defined sphere.

In order, therefore, to make the most of the possibilities of the appointment it is desirable that the office of the Consulting Architect to the Government of India should always be the senior appointment in India. It should be such as to attract the most able and experienced of our architects. This being so it is essential that the post should be one for a "live man" in full exercise of his professional functions, and not one content to be a mere inspector and scrutiner of the work of others. Therefore his sphere, when defined, should be such as to provide him with the handling of works of the more important class, such as even now are of somewhat rare occurrence in his practice, and will become rarer as the process of devolution goes on. It is true that when the Government of India fairly takes over "New Delhi" from the provisional "Imperial Committee" (for whom special arrangements have been made as to architects for the special work of constructing the new city) a widening of the sphere of the Consulting Architect to the Government of India will be the result. But a considerable number of years must elapse before this can take place.

(4). *The Consulting Architect to the Government of India and "Imperial works."*—In the meantime in order to secure to the Consulting Architect to the Government of India the handling of a due number of buildings of major importance I wish to make the following suggestion:—

The provincial architects now (in normal times) are chronically overworked, and fresh work pours in on most of them at a ratio greater than that of any increase of staff that it has been possible to provide, or that can reasonably be expected. Even with considerably increased recruitment of architects, this state of things will continue for many years, and may, indeed, continue indefinitely. I suggest that full use should be made of the Consulting Architect to the Government of India to relieve this pressure. But it would not do to wait for the initiative in this matter to come from the provinces. That would result in making the senior architect to be

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dependent, to some extent, on the *leavings*, as it were, of the others. The Consulting Architect to the Government of India, therefore, should be definitely given the designing of certain larger "Imperial works", that is post and telegraph offices, custom houses, etc., wherever required costing, say, rupees 2½ lakhs (the limit at which technical sanction by the Government of India is required) and over. Apart from such advantages of this arrangement as may be considered directly to affect the Consulting Architect to the Government of India himself and his appointment, there are even greater advantages to government generally. These imperial buildings are chiefly the concern of imperial departments, and it is impossible for an architect not at the imperial headquarters to give full effect to the wishes of those departments. I say this particularly from my own long experience of working with the Director-General, Posts and Telegraphs, on the design of post and telegraph offices. My experience of the design of custom houses is also confirmatory. Local opinion and ambitions in such matters tend to the inflation of the particular project. The natural rivalry of one port with another, for example, has been clearly seen in recent instances as tending to the impulse to "go one better" in the matter of the scale and costliness of custom house accommodation. The same is true to some extent of post offices, etc. Only the department of the Government of India concerned is in a sufficiently detached position to hold the balance even between local and imperial interests, and to gauge the intentions of the Supreme Government as to expenditure, and these departments have not a sufficiently free hand unless they have their own architect to give effect to their wishes.

Economy and good administration alike point to the desirability of some such standardization of the accommodation in these buildings as can only be accomplished by having them dealt with in one central architect's office. This suggestion is in line with home practice, under which such buildings are dealt with by the architect of His Majesty's Office of Works in London. The Consulting Architect to the Government of India, in fact, would be somewhat similarly situated to the principal architect of His Majesty's Office of Works.*

There appears to be no tendency on the part of local authorities at home to complain of any infringement of their prerogatives under the system. It is true that at home no administrative sub-divisions exist comparable to the Indian provinces. With local administrations of such ponderability difficulties are to be apprehended such as do not arise in carrying out works on territory over which smaller local bodies (such as county councils and town councils, etc.) rule. Local jealousy of central authority no doubt exists at home, but just why, in the case of India it should be found in an aggravated form has never been explained. It is not clear whether it arises from some flaw in our administrative measures or is merely a hint that the human heart does not expand with territorial limits. I would remark that no difficulties are experienced, even in India, by the Military Works Department in carrying out works on provincial territory, and in administering these from Simla. However to create an exact parallel, the Government of India would have to remove the cost of the buildings in question from the provincial budgets and also, perhaps, to maintain in some form an imperial works service. But these are measures for which (though I think it well to mention them here and now) the full expediency can hardly be properly gauged at present.

At any rate, seeing that no undue amount of local jealousy is aroused by administering the post and telegraph offices from Delhi or Simla, it need not be supposed

that there would be the least objection on that account to issuing, also from Delhi or Simla, the designs for the buildings to house these offices locally. So much for the designs. I am prepared to admit that it might be unwise to attempt at present any closer link between the architect at imperial headquarters and the execution of works from his designs than exists, say, in the case of the Delhi works and the London architects thereon employed. The shorter distance and greatly less restricted communications between Government of India headquarters and any part of the Indian Empire than between London and Delhi would itself strengthen the link, and would obviate the necessity for maintaining a local branch of the office of the Consulting Architect to the Government of India, as well as for anything like the protracted visits made every year by the London architects to Delhi. In other words I think that, in the case of the Consulting Architect, Government of India's designs, the arrangements for carrying out these may be left to the local administrations as heretofore.

The Consulting Architect to the Government of India could assist the latter by being in a position, from his touch with all local architectural centres, to arrange, if necessary, for the transfer of a suitable man to take charge of any special division or sub-division—either a senior assistant architect or an engineer, accustomed to the construction of such works, or he might lend someone from his own staff. For the rest, with the general strengthening of the position and influence of the architect in the Public Works Department, together with the freer opportunities of touring which the Consulting Architect to the Government of India (as well as the other architects) ought to have, I have every confidence that the problem of touch with works would be sufficiently solved. It has to be borne in mind that the Consulting Architect to the Government of India, as the senior man of his service, will presumably have had so much practice on works in his former appointments that the same need does not exist in his case, as in that of younger men, of continuing him in the exercise of the executive faculty. When the Government of India finally settles down in new Delhi, (and especially if it also acquires its own territory at Simla), the Consulting Architect to the Government of India could stand in exactly the same relation to works on that territory as the provincial architects to works on provincial territory. Naturally the Consulting Architect to the Government of India must always have to deal with a large proportion of designs for works, from sources already enumerated, as to which his direct control over works can hardly be arranged for.

(5). *Co-ordination.*—In the present backward state of architectural taste and knowledge in India, and in view of the extreme desirability for general progress, it is hardly possible to exaggerate the importance of the functions that might and should be exercised by the Consulting Architect to the Government of India as a co-ordinating link between the various provincial centres. To this end it should be his duty to devise such means as from time to time can be applied without prejudice to local prerogatives. The Consulting Architect's Architectural Report* might be improved and greater co-operation in it be fostered on the part of the provincial architects. Triennial conferences of architects and others interested in building and the building crafts should be arranged for, and a steady effort maintained to guide architectural progress on lines distinctive and appropriate to the growing needs of India. Then there is the question of the technical training of architects in India. It is only the Consulting Architect to the Government of India who is in a sufficiently detached position to constitute himself the medium for all such matters, or who, from his comparative freedom from the stress of purely local affairs, can take the requisite wider view. Again, with the growing architectural establishment generally which I prefigure, the advantage to the administration of having at hand in the Consulting Architect a professional man in close touch with the

* Since the retirement of Sir W. Tanner, the late Principal Architect, in 1914, His Majesty's Office of Works has been split into three sections, each under a Principal Architect, each of these answerable to His Majesty's Commissioner of Works. This, however, is regarded as a temporary measure mainly due to the growth of the office having necessitated housing it in three separate buildings. I understand that it is intended to bring it together again under one technical head whenever possible.

* Now to be discontinued for the present.

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personnel of that establishment throughout the country, and acquainted with the several characteristics and capacities of the men, will be more and more apparent.

(6). *Consultations.*—The Consulting Architect to the Government of India should, therefore, be made available in a fuller manner than heretofore for consultation by local Governments and their architects. Building projects are essentially matters on which two heads are better than one. I should be in favour of making such consultation compulsory in the case of all works requiring the ultimate sanction of the Government of India or the Secretary of State. In the case of all other works above a certain size local Governments and their architects might be invited to confer with the Consulting Architect to the Government of India at an early stage of the design.

I am aware that I am here treading on slippery ground. Nevertheless, I am strongly convinced it is ground that must be trod, otherwise the alternative is to allow the various provincial centres to become more and more detached, and to cut off the imperial government from knowledge of and sympathy with an important and growing channel for their subjects, higher interests. The art of the country—and building is the mother of all arts, needs some of the fostering care of the central government just as does its commerce or its education.

The architects in the Public Works Department are detached units in the service of their several governments. Each is professionally a free-lance. Most show unmistakable signs of a desire to cling to that condition, each going his own independent way unconnected with any other or with a general plan. It is not surprising considering their isolation and infrequent opportunities of intercourse. The result is like to be chaos, if, indeed, it is not so already. A "medley" describes the aggregate of the architecture that is now being planted on Indian soil. The older architectural efforts of the Public Works Department—those of the engineers—whatever their shortcomings, had the merit of a very considerable co-ordination and consistency—the result of Cooper's Hill and the feeling of solidarity implanted in the men by that and their common service conditions. It is this quality that enabled their work, albeit amateurish from the architects' point of view, to attain so high a general level.

In the architects' profession at home there is a body of professional opinion fostered by the Royal Institute, the many allied institutes and associations, and the constant intercourse these promote. During the last quarter century this has been sedulously extended to the professions on the Continent and in America into a real international professional *entente*. From all this our architects here are practically cut off, as well as from one another. There is no body of professional

opinion for India, where it is so greatly needed in the interests alike of general architectural progress and of the growth of an indigenous profession.

By a judicious use of the appointment of the Consulting Architect to the Government of India I see the one possible means of bringing about the desired *entente*, especially in a country where all progress in every direction has to come so largely from the initiative of government. The fear of having authority imposed will be the main obstacle. It must be clearly understood that the Consulting Architect to the Government of India's relation to the other Government Architects is in no sense to be one of authority, but rather of influence, unifying, helpful and, if restraining, only so by means of persuasion and tact. That is why I lay stress on consultations, together with possible conferences and the Annual Report.

(7). *Status of Consulting Architect to the Government of India.*—Finally with a view to the appointment of the Consulting Architect to the Government of India being the senior appointment, and to possible succession to it being an incentive to the whole profession; with a view also, directly to its general efficiency and influence, it should be recognized as analogous to appointments such as that of the Inspector General of Irrigation and should carry status equal to that of a Chief Engineer. It might be called "Chief Architect with the Government of India."

(8). To sum up, the measures which I suggest should be effected with respect to the office of Consulting Architect to the Government of India, are these:—

(a). The Consulting Architect to the Government of India should be definitely made responsible for the design of all imperial buildings, costing rupees two and a half lakhs and over, wherever required.

(b). The sphere of the Consulting Architect to the Government of India should from time to time be clearly defined with respect to all sources from which he draws his work.

(c). In the case of all building projects requiring the technical sanction of the Government of India the Consulting Architect to the Government of India should be consulted at an early stage of the design.

(d). In the case of other major building projects local Governments and their architects should be invited to consult the Consulting Architect to the Government of India.

(e). The Consulting Architect to the Government of India should arrange for triennial conferences of architects, etc.

(f). The Consulting Architect to the Government of India's Annual Report should be improved, and a greater co-operation in it secured from local Governments and their architects.

(g). The Consulting Architect to the Government of India should be called "Chief Architect with the Government of India," and should have status equal to that of a Chief Engineer.

MR. J. BEGG called and examined.

4,827. (*President*). The witness stated that he was the Consulting Architect to the Government of India and that he had held that appointment since 1908. He had had 16 years' service in India having joined the Department in 1901.

4,828. His central idea was that the Architects might be said to have authority without responsibility, and the Executive Engineers responsibility without authority, and to obviate this the Architect should not merely design buildings but should also be concerned with their construction. He had advanced the suggestion in his written statement in a tentative manner, but desired to point out that it was not necessary that the Architect should in every case carry out his designs in his own person, but merely that he should stand somewhere in the line of authority, and not simply on one side as a critic, i.e., that instead of being a designer only of buildings, he should also have executive powers. A suggestion had been put before the Committee that where there was sufficient building work of importance in progress such work should form a separate buildings division

manned by Architects, but he wished to carry that suggestion a little further. He therefore advocated the establishment of architectural sub-centres at suitable points in major provinces. For instance, in a province like Bombay it might be found that a large amount of work was required to be executed in Poona. It might be better therefore to establish a branch of the architectural office at the latter place so that work could as far as possible be designed on the spot and carried out there rather than from the central office. The sub-centre office would, however, necessarily be under the supervision of the central office. His main idea was that the buildings in India should be formed into a separate Architectural or Buildings Branch. Such a scheme could, of course, only be developed gradually but it would be perfectly workable. At the same time he looked to entrusting a number of less important works to other agencies. His scheme would therefore bear modification to suit particular localities; it probably could not be applied to the whole of India. It would, however, be consistent even if minor buildings were

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handed over to the Architect, as such was the practice in other countries.

4,820. His experience had been that a great deal of overlapping occurred by reason of the fact that the executive branch was separate from the designing branch. A great many designs had, as a matter of fact, been submitted to him which had to be re-drawn, and, since the Architect was not sufficiently in touch with the executive agency concerned, certain of the drawings had sometimes to be again re-drawn when received by that agency. The witness had found, moreover, that when his instructions had to go through a middle party, an Executive Engineer's office, he had to explain matters much more fully than would be necessary if he could get into direct communication with the workmen. The Executive Engineer was responsible for the construction of a building and had to satisfy himself in this connection. That officer therefore frequently preferred to execute his work in a way other than that advocated by the Architect. He did not insist that the whole of the buildings in India should at once be handed over to architects, as such a course would not be feasible in certain places, but he desired to see the Buildings Branch recognised as the Architects' Branch. Other branches should undertake the construction of the minor buildings in places where substantial expenditure was not incurred on the construction of buildings.

4,830. With regard to the difference of opinion in connection with the present practice under which, in addition to the preparation of their own designs, provincial Architects generally undertook the scrutiny of designs for scattered buildings in the *mofussil* prepared by Public Works Department officers, some Architects being of opinion that such scrutiny was useless as the examination of other peoples' designs involved a great waste of time and generally meant the preparation of another design and accordingly that they should either prepare the original design of a building or have nothing to do with it, others, on the other hand, being of opinion that the scrutiny of designs enabled them to suggest certain improvements and that it was therefore worth the trouble and time spent in this connection, the witness stated that there was something to be said for both views. He was inclined to the view, however, that while there must be scrutiny by Architects such scrutiny was, with designs of the average quality usually submitted hitherto, not worth the trouble frequently spent on it. There was a certain amount of advantage but not enough to justify the trouble, because in the majority of cases it meant that the Architect found that he could not really do enough in the matter of improvements and had to set to work with the preparation of a new design, and this formed part of the overlapping he had previously referred to.

4,831. He agreed with the suggestion that, if the scheme he advocated were adopted, the Consulting Architect to the Government of India as head of the Architectural Branch should be provided with one or two Assistant Architects to cope not only with designing but also with the inspection of works in progress. With regard to the suggestion that clerks of works should be recruited from England to undertake in India exactly the same class of work such men performed in England, he was of opinion that, although that method of working was an ideal to be aimed at, it was not necessary to recruit all such men from England. He preferred to train Indian talent to perform the necessary functions. It might be necessary to bring out one or two such as instructors, in the first instance, but it was not necessary to establish a regular system for the recruitment of clerks of works from England.

4,832. He did not agree with the suggestion that since building trades in India were at a very low standard master craftsmen, bricklayers, plasterers, painters and carpenters should be recruited from England to any considerable extent. It would be a dangerous procedure and not a step in the right direction because the people in India were quite capable of undertaking such work, and could be trained to the necessary standard. It might, however, be advisable to recruit a few such crafts-

men in the first place only to help in their training but this should be done with great caution.

4,833. On the assumption that the Architectural Department was self-contained as he suggested, his opinion was invited in connection with its relations to engineering. He was informed that the view of certain Architects was that there was no need for an engineer in such a department as architects were fully competent to design all buildings, to calculate all stresses and strains connected therewith, and to work out all steel-work construction, also that certain other architects considered that although they were competent to calculate the stresses and strains in connection with steel-work, it was desirable that an engineer should be attached to the Department to deal with the technical engineering problems connected with the designs of buildings. He replied that Architects were supposed to be conversant with and actually carried out such work, but that an expert was frequently employed in this connection in England in the office of the architect, who, although he knew the theory and was fully competent to apply it, was not necessarily in constant practice in dealing with such problems. He therefore considered that in the conditions obtaining in India it was desirable that an engineer (say a young engineer) should be attached to the Department for the more special calculations, as a measure of economical establishment administration. An architect would not design anything of which he did not know the constructional theory. He advocated the employment of an engineer in connection with reinforced concrete steel domes and the like. Such officer would not necessarily be permanently attached to the Architectural Branch and recruited *ad hoc*, but could be attached to the branch for a time until he became too senior. Such officers could, in fact, be borrowed from the Engineering Branch when required.

4,834. The present system of recruiting architects for the Public Works Department who were Associates of the Royal Institute of British Architects in England, and who had been recommended by that Institute, was satisfactory. The question whether the possession of that qualification connoted sufficient practical experience depended on the appointment for which an architect was recruited. If the officer concerned were a young man he would gain his practical experience in India, but if he was recruited for a senior appointment he should be a man who had spent a number of years in actual practice. Provincial Architects should be recruited at an age of between 30 and 35 years, certainly not younger, and Assistant Architects at the same age as Assistant Engineers, i.e., at about 25 years. He was in favour of engaging Architects in the first instance on a temporary agreement for a probationary period of say two years; subject to their being made permanent after such period had been served. In his opinion, the capacity and business management of an Architect could be judged sufficiently within such a period if judged by his fellow Architects. A period of two years would not be too long for a man, if he did not desire or were not required to remain in India, to resume his place in the profession at home.

4,835. As regards the status of the Architect recruited from England, he recommended that, on the completion of his probationary period of service, he should take the same place on the ordinary Public Works Department list, ago for ago, as the civil engineer. The objection to a permanent architectural service, viz., that it would result in one Architect being in a province for a number of years without a change of methods of design, could be met with advantage by general co-ordination of effort and by transferring Architects a little, and local Governments would perhaps agree to such an arrangement as they had to put up with it in the case of other officers. The Architect should be made to feel that he was on precisely equal terms with the engineer, but if the latter were recruited on a temporary basis, the Architect would have no claim to be made permanent. His claim was based on the fact that the Architect and engineer worked together and could only be expected to do so and live

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together amicably provided they were on equal terms in every way. Besides the merits of the one profession were not superior to those of the other as the two were practically on the same level, socially, etc. He himself was not pensionable. As a matter of fact no Architect with the exception of one, was pensionable, but all Architects thought that the pension was recognised as giving a certain *cachet* and he himself would certainly like to feel that he was pensionable like other men in the Department.

4,836. Asked whether a pension or a provident fund would attract the best material to the service, he replied that there was not really very much to choose between the two provided the provident fund was actuarially equal to the pension scheme, with the exception that if a man was not pensionable he was usually not permanent but subject to six months' notice. He did not think it would be a material advantage at present to recruit Architects on a provident fund basis with a view to their being more inclined to take up private practice and thus develop architecture in the country, as he considered that too much had been made of the private practice of government Architects. It was not a good system; private work had always been held out as an inducement to the Architect to come out to India in government service, but it was not a good principle to mix up the two classes of work. He was, as a matter of fact, of opinion that the private work inducement should be abolished because it was an undue lure to recruits, and raised hopes not destined to fulfilment. The government Architect had practically no time for such work.

4,837. He advocated the recruitment of Architects from England for the present. He had been instrumental in establishing the Architectural Branch of the School of Art in Bombay. It had been improved and was now doing very good work, and the proposals for reorganizing and extending it, in order that a much more detailed course in architecture could be given, were on good lines. He contemplated that as that school in common with others of a similar nature, developed, recruitment of Architects might, after a time, be made in India. But he did not agree with the view that, if it was intended to establish a school of architecture in India, it should essentially be Indian and manned by Indians. It was desirable to employ Indians to the fullest extent but the fundamental principles of architecture were not local but universal. A country should certainly employ its own talent so far as it possessed it but it was necessary at times to supplement such talent from other countries as was the case at present where men from England were recruited both for training and actual work. He was confident however that the time would eventually come when such training by Europeans would no longer be necessary, but that India would be more or less self-contained in this matter.*

4,838. The successive provincial appointments of Consulting Architects had led to a corresponding devolution from the sphere of the Consulting Architect to the Government of India which might now be said to consist, so far as designs were concerned, of:—

- (1). The Government of India's own buildings in Simla.
- (2). The Central Provinces.
- (3). The North-West Frontier Province.
- (4). Assam.
- (5). Baluchistan.
- (6). Central India.
- (7). Rajputana.
- (8). Buildings required by the Military Works Department.

* Mr. Begg afterwards wrote:—"The fact is not given unqualified recognition (at any rate in the Public Works Department) that India already has both an architecture and a set of building traditions, and that no architect, instructor (professional or technical) or workman should be brought to the country who does not realize this, and who does not also recognize that, because of this, all his efforts should be in the direction of helping on that architecture and those traditions, co-ordinating them, and bringing them gradually into line with modern methods of thought and with modern conditions generally."

- (9). Buildings required by the Railway Department.
- (10). Occasional buildings by special request of imperial departments.

(11). Occasional buildings from miscellaneous sources. The major provinces employed their own Architects. Very little provincial designing work was therefore executed by the Consulting Architect to the Government of India, most of the latter's work being connected with Simla, the Central Provinces, the Military Works buildings and some buildings of the Railway Department. In his opinion the Central Provinces would soon develop sufficiently to justify the employment of a whole-time Architect by that Administration. This proposal had as a matter of fact already been discussed. Bihar and Orissa too, he thought, would before long require the services of a permanent Architect as the present incumbent could only be considered on a temporary basis, like the Architects employed in Delhi. So far as he was concerned, the minor Administrations and other sources of work in the above list kept him fairly well employed. As regards the buildings of the Military Works Department, he was employed in the preparation of designs for the new Delhi cantonments and the like. In addition, he sometimes prepared designs for the other cantonments in India but not very many as these were all more or less constructed on standard plans. He had found, however, that the tendency lately had been growing of sending him standard plans with the object of effecting improvements. There had also been a steady flow of work in the preparation of designs for cantonment churches, but the construction of such work was not now carried out at the same rate as previously. When the Military authorities required the construction of a church they applied direct to the Consulting Architect to the Government of India for the design, since the funds were centralized and the work was imperial. The work connected with the preparation of designs for buildings required by the Railway Department amounted to very little, but might increase in future since the tendency to consult him as to the lay out of station buildings and the like appeared to be growing.

4,839. He recommended that the appointment of Consulting Architect to the Government of India in the Buildings Branch should be recognised as analogous to that of the Inspector-General of Irrigation in relation to the Irrigation Branch of the Public Works Department. In his opinion the Consulting Architect should advise the Imperial Government on all questions relating to architecture, buildings, appointments and professional education of Architects. The Government of India at present had the onus of sanctioning and approving work and criticising designs. The limit fixed for the sanction of provincial works was Rs. 16 lakhs, but the provincial schemes in excess of that amount were quite sufficient to justify the employment of the Consulting Architect to the Government of India for the purposes of technical scrutiny. A certain amount of pecuniary benefit accrued from the professional scrutiny of designs in the Government of India. He had for instance recently saved about Rs. 2 lakhs on a particular building, the design of which had been submitted to him for scrutiny. This sum had been saved by scrutinising the estimate very carefully and deciding that certain items were not necessary or might be constructed on a cheaper scale, without unduly changing the accommodation and appearance of the building. So long as the Government of India accorded technical sanction to the construction of works, the Government Architect should be the person to effect the necessary technical scrutiny.

4,840. The Consulting Architect to the Government of India should act as a co-ordinating link between the several provincial centres. The matter was a difficult one, and had its dangers; it would consequently require a great deal of tact but India at present suffered from each provincial centre acting too much on its own initiative without relation to the others. All the local Architects, as a matter of fact, desired to act independently and were unduly afraid of being interfered with, and the government and provincial Architects, therefore, did not co-ordinate their efforts sufficiently. The Consulting

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Architect should, in his opinion, be able to help things along in that direction. He admitted, however, that architecture was one of the arts in which, if it were to have the most successful results, it was necessary to give a fairly free hand to each man individually * and that architectural authority should not be unduly exercised by the head of the branch; and explained that, as a matter of fact, he desired only to use influence not authority. He advocated the convening by the Consulting Architect to the Government of India of conferences. It was fitting that such conferences should be organized by the head of the service since such was the regular official procedure.

4,841. The appointment of Consulting Architect to the Government of India was a safeguard to imperial interests. That officer should therefore be given the designing of the larger imperial works. All provincial Architects no doubt desired to undertake the designing of such works, but if these were undertaken by the imperial Architect he did not think such a course would remove any appreciable attractions from the provincial appointments, since the imperial buildings required in any one province were not very many and there was not a very large expenditure thereon. It would therefore not entail a great loss of opportunity to any individual provincial Architect, as there was plenty of high class provincial work for that officer to undertake in the shape of secretariats, high courts, etc., etc. As a matter of fact the best work in a province was provincial work, and the most costly work probably that of the construction of high courts. Such buildings as custom houses were imperial buildings and should be designed by the Architect to the Government of India, as he would be in a better position to prepare the designs than the provincial Architects, particularly as he was more in touch with the administrative departments concerned. It was true that he might not be in touch to the same extent with local conditions, local materials, local building work and labour conditions. This was certainly a restriction and might in the first instance hamper him somewhat in the preparation of his designs, yet he could very quickly find out all he required to know in this connection, and the advantages would be greater than the disadvantages.

4,842. Provincial governments were naturally not quite so careful in controlling the expenditure incurred in the construction of a building for the imperial government as they were in the case of a provincial building. When he was Consulting Architect to the Government of Bombay he was given the preparation of the design and construction of the general post office in that city. He felt that it was rather 'slung at him' as it were, and that the procedure was not quite on right lines, and had had difficulty in obtaining any instructions from the local Government as to the proper scale of expenditure

on the building. He therefore thought it would be better if the imperial Architect undertook the preparation of designs of such buildings. He did not contemplate the creation of an imperial works service as he considered the adoption of such a system would not be advisable. In cases in which imperial buildings were designed by him, the construction should be undertaken by the local authorities. It might be possible to send down to the province concerned a representative as a clerk of works for an important building. The imperial Architect would have to be very careful not to appear to be giving orders, and in fact, in the construction of an important building, matters would remain much as they were at present. He admitted that the adoption of such a course conflicted to some extent, but not entirely, with the central principle on which the whole of his scheme was based, viz. that the Architect should not only design buildings but should also be responsible for, and have due powers over the construction thereof, but explained that the Government Architect would presumably be the senior man in the service and would have had experience in the provinces and be in touch with work there and know what to specify. His position could be sufficiently strong without actually putting him in the direct line of authority in such cases.

4,843. The Consulting Architect to the Government of India might be in a better position than anyone else to advise in the transfer of the staff from one province to another, as he was acquainted with the personnel of the different provinces. He did not mean, however, that he should have actual powers in this connection.

4,844. (Mr. Cobb.) He did not suppose provincial architects would look with favour on the suggestion that the designs of imperial works should be prepared by them subject to the approval of, or revision by, the Consulting Architect to the Government of India, since they would feel their position even more than if the work in question were not placed in their hands at all. As a matter of fact, many of the provincial Architects had not been tried in an outside profession and very few of them had been much more than assistants in an office in England. There was a great gulf between assistant and principal at home so that when they came out to India they appreciated their new freedom and did not wish to return to anything like their former subordinate position. It would be a good plan if the imperial Architect were allowed to make certain suggestions for arrangements in particular cases, for instance, if in Madras it was contemplated to construct an imperial building and he thought there was a suitable architect in that city who could prepare the necessary design and who should be allowed to do so, he should say so. The design for the post office in Bombay prepared by the witness when Architect to the Bombay Government, had been scrutinized by the Imperial Government Architect. The designs of all such buildings were still supposed to be scrutinized by that officer, but the question whether he invariably did so depended very much on the individual officers in the imperial Public Works Secretariat at the time, as there were no rules in this connection and it was left to the discretion of the Secretary or whoever in the Government of India dealt with the particular case, whether the Architect should be consulted. This was not satisfactory.

4,845. Co-ordination between the imperial and provincial architects was desirable not entirely in connection with expenditure, but also because all architects were apt to stagnate unless their work was subjected to some wholesome professional criticism. They were all at present much too separate one from another, and did not get the opportunity in the ordinary course of their duties to exchange ideas as was the practice in England.

4,846. With regard to the improvement of the building crafts he stated that all architects felt that, if they could get into direct touch with the workmen concerned, a considerable improvement would soon manifest itself

* Mr. Begg afterwards wrote:—"I wish to qualify my assent to the above proposition as to the art of architecture. In so far as it applies to all arts and professional occupations my assent is unqualified. But it has recently been sought to apply it to architecture in a special sense by those desirous of conserving the old Public Works system. It has been represented as a reason for keeping the Architects isolated in order to check the growth of their influence. In this I do not agree. No man especially in a public service ever can be given a free hand. Moreover, a large part of the Architect's work must always consist in his having to tackle his problems with his hands tied, more or less, by restricting conditions of various kinds, not only unnecessary, like the inertia of the works system and the distrust that comes from ignorance and misapprehension, but also necessary, like financial restrictions, particular requirements, conflicting individual tastes, etc. In this struggle with conditions inherent in every problem it is not the "free hand" the Architect requires so much as sympathy, confidence, appreciation and protection from non-professional and other irresponsible criticism. To give him a chance of these he ought to be brought into co-ordinate relations with his fellow professionals similar to those enjoyed by the members of other professions in government service."

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[Continued.]

but he did not think technical schools would improve the situation very much.*

4,847. (Mr. Mackenzie.) The Government Architect in Bombay had an executive division under him with an Executive Engineer in charge who with his staff carried out the necessary work. Rather a different system was in vogue in the Delhi Administration where the Engineer was in charge of the buildings. The Architect's recommendations might be referred to the Chief Engineer, but were as a rule carried out by the Executive Engineer who was responsible for the workmanship. Such system, as a matter of fact, obtained throughout the rest of the Public Works Department in India. He had been instrumental in establishing the system adopted in Bombay. In his opinion it was the better system when it could be applied. Most Architects would go a little further and man divisions by Architects provided they had sufficient experience of the country, but it would not be a good principle to bring out Architects raw to India and place them in charge of works. Such men should begin in an office, but construction divisions should ultimately be manned by Architects. Such a procedure would not clash with the encouragement of private practice and indigenous architecture but rather the reverse. Government, by looking on the Architect as a sort of subordinate to the engineer, was showing the profession in rather a poor aspect, and it did not therefore appeal to the public of India; they did not think it was a profession worth taking up, and were not encouraged in this direction. Some Architects received extra pay for private work, but he did not think, on the whole, that they made very much money in this manner. He himself had made very little out of private practice during his service, since he had been fully occupied with government work. With respect to the question whether the emoluments of the Architect were sufficient to attract good men to the service, he thought that the officers holding some of the higher posts were fairly well paid, but that such could not be said of the younger officers. A salary of Rs. 800 to Rs. 1,000 was too small for a province like the Punjab and there were many other instances.†

4,848. (Rai Bahadur Ganga Ram.) He was in favour of the encouragement of private practice in India and was of opinion that even if all the provinces employed their own permanent Architects for government work there would still be sufficient private work for Architects, if the public could only be got to recognize this. After a private architectural profession had been built up in India, a system under which a retaining fee would be given to the Government Architect for advice in connection with the construction of certain buildings, designs being given out to private architects by competition

or otherwise, or some similar system, could be adopted; but it could not be applied at present, since there was not a sufficient number of qualified men in the private profession. He did not agree that if Architects were permanently located in the provinces there would not be sufficient work for private practice, as he considered that the more Architects there were the more work would be available. If a man were given a retaining fee by government and allowed to add to his income by the execution of private work it did not follow, as things were at present, that private practice would be increased. Private practice could be fostered in India only by letting people see, by the employment of good Architects, government buildings of a good appearance being constructed. He did not think that the systematic interchange of Architects after they had served in one district for three or four years, in order to provide a field for other Architects, was feasible. Although the system of employing Architects in one province for a good number of years had been condemned in some places by the public, he was of opinion that matters in this respect would adjust themselves in due course as the public taste became educated. He was in favour, however, of transferring Architects to a limited extent from one province to another, to meet leave and other service exigencies.

4,849. He did not think that the encouragement of the system under which engineers who had a taste for architecture should, after 10 years' service, be sent to England with the object of studying architecture would be of much use, being of opinion that the Architect and engineer looked at things from two different points of view—if a man were a good engineer he would not necessarily be a good Architect and vice versa. The study of building design and execution was a life's work, and could not be applied as a "top-dressing" over other professional attainments.

4,850. (Sir Noel Kershaw.) The great point in the establishment of private practice in India was for the public actually to require and appreciate the services of Architects. The employment of Government Architects had had a good effect on the public as there had been a great demand for such men since their advent. The private architects in India consisted of a few firms in Bombay, Calcutta, Karachi, etc. One of the firms in the former city undertook very little work when they first began in India but their work had extended tremendously in recent years. Generally speaking there were no signs of new architectural firms springing up in any number. The more government did to show their appreciation of their Architects the more private architects would be induced to come out to India with the object of setting up for themselves. He was really the first professionally trained Architect recruited for government service in India and that was 16 years ago. The list now numbered over twenty men.

4,851. The small buildings in England were designed by trained surveyors who were to that extent architects although not highly trained in that profession. He would not say that such men were not in any sense trained architects since they had to learn a great deal of what architects were taught. Neither did he think that such men partook more of the nature of engineers than the ordinary surveyor but, although he did not know very much about them, he was of opinion that they stood between the two.

4,852. The system under which the Government Architect undertook private work was not a good one. If a provident fund system were introduced it was quite true that a man, if he saw an opening in the public market, could leave government service and avail himself of the opportunity, but he would not of course be entitled to a pension. The witness admitted the point as being one in favour of the provident fund system, though he had not thought of it previously.

* Mr. Begg afterwards wrote:—"I feel that the time has by no means come to apply technical education in the building trades in India. The men's general level of education is not high enough. On the other hand they have very pronounced traditional constructive and craft aptitudes and instincts which any formal technical instruction we might give them would be apt to kill.

I feel strongly that the thing to do is to educate them technically through their work, to get them to do their work well, to sharpen their tools, to be accurate and thorough and to pay attention to workmanlike "finish." Above all—and to these ends—we must get them to take pride and interest in their work for its own sake, and for that, again, we must apply them to work in which they can take an interest. I suggest that engineer control, in the case of work in the building trades, has, for obvious reasons, in no way discreditable to the engineer, a certain effect deadening to that interest in work for the work's sake which would be removed if architect control were substituted."

† Mr. Begg afterwards wrote:—"But it is not the pay we chiefly think of in engaging to come to India in government service. We look rather to obtaining such opportunities and such recognition as will enable us to fulfil our ambition to rise in our profession. The present system does not bring us either not even the first to a satisfactory extent."

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HON'BLE SIR REGINALD GAMBLE.

[Continued.]

At Simla, Monday, 23rd April 1917.

PRESENT :

F. G. SLY, Esq., C.S.I., I.C.S. (*President*).

SIR NOEL KERSHAW, K.C.N.

G. S. COBB, Esq., M.V.O.

RAI BAHADUR GANGA RAM, C.I.E., M.V.O.

A. T. MACKENZIE, Esq.

D. G. HARRIS, Esq. (*Secretary*).

The Hon'ble Sir Reginald Gamble, Kt., I.C.S., Comptroller and Auditor General.

Written Statement.

[N.B.—The views expressed are purely personal and are in no way those of the Government of India.]

4,853. Sub-heads of estimates. The question referred for my opinion is whether there is any objection from the accounts point of view to increasing the present limit of Rs. 5,000 up to which it is necessary to record the outlay on works by sub-heads, or to reducing the number of sub-heads usually adopted.

(2). Audit by sub-heads of estimate was in force prior to 1889; but was abolished in that year on the recommendation of the Public Works Accounts Committee of 1888-89. The present audit procedure is confined to seeing that the totals of the estimates are not exceeded without proper sanction. The divisional registers of works, however, record the outlay on all works estimated to cost over Rs. 5,000 in detail of sub-heads and, during audit inspections, these registers are scrutinised (paragraph 1763, Volume II of the Public Works Department Code) to see that executive action is taken, as required by paragraph 275, Volume I, of the Public Works Department Code, in all cases of excesses or probable excesses in the rates or cost of a sub-head. A theoretically perfect audit concerns itself only with totals of estimates, but requires that the estimates should be accurately framed in the first instance and that all excesses should be brought to the notice of the proper authority as soon as they occur, or are foreseen, in order that audit may have, at the earliest opportunity, the requisite sanction for admitting the extra charges.

(3). The object of the system of recording outlay by sub-heads is to enable the executive officers to keep in touch with the progress of expenditure and to intervene, as early as possible, with a view to checking extravagance in rates and unnecessary outlay, or, in cases where excesses are unavoidable, to obtain the sanction of competent authority to revised estimates against which audit may be conducted. The limit used to be Rs. 2,500 prior to 1889, when, as a result of the recommendations of the Public Works Accounts Committee of 1888-89, local Governments and Administrations were empowered to raise it to Rs. 5,000. In 1909 it was definitely raised to Rs. 5,000 for all provinces (S. O. 109 to paragraph 1290, Public Works Department Code, Volume I). I am afraid that Public Works officers often do not realize their responsibility for effective financial control and I doubt the advisability of raising the present limit; but if the executive officers have convinced the Committee that they can really exercise the requisite financial control without the aid of sub-heads in the case of works costing more than Rs. 5,000, I have no objection, from the audit point of view, to offer to the limit being raised to, say, Rs. 7,500 or Rs. 10,000.

(4). It is true that in the case of the larger projects the number of distinct items of work, and consequently that of sanctioned sub-heads, is comparatively greater than in the case of the smaller works; but, at the same time, the necessity and utility of sub-heads, as an aid to effective financial control over outlay, is the greater the larger the work. Between 80 and 90 per cent. of the works of a Buildings and Roads division, are estimated to cost Rs. 5,000 or less. The number of major works is

not very large at present, and the proposal to reduce it further needs careful examination. A statement* which has been prepared in the Punjab account office and which shows the number and cost, during two years, of the minor and major works of two of the divisions of that province (selected at random) is enclosed, as it may be of assistance to the Committee in forming an opinion.

* Annexure I.

(5). In this connection it is perhaps advisable to mention that, in the budget estimates, only a lump sum provision is made for minor works under each service head (paragraphs 1704 and 1819, Volume II, Public Works Department Code). Any decision to raise the limit of Rs. 5,000 fixed for Minor Works, will have the effect of relaxing to some extent the existing detailed budget control over the outlay on the larger works unless it is expressly ruled that there shall be no change in the budget procedure.

(6). As to the suggestion to reduce the number of sub-heads. It will be seen from paragraphs 658 and 659, Volume I, Public Works Department Code, that the determination of sub-heads is a matter left to the decision of executive officers. There are no hard-and-fast rules on the subject: nor can there be any, as the sub-division, intended as it is primarily and essentially for the exercise of financial control, depends on varying factors such as the nature of the work and the actual mode of execution. This question was carefully considered by the Government of India in connection with the report of the committee of 1888-89 and the conclusion arrived at was published in Public Works Department Circular No. 24-P. W., dated 29th October 1889. No grouping of dissimilar sub-heads for the purpose of saving clerical work should be permitted, as this would militate against proper financial control. The present rules (last sentence of paragraph 1290, Volume I, Public Works Department Code), however, contemplate sub-heads of Rs. 500 and under being lumped together in the registers of works. If desired, this limit of Rs. 500 might be raised to Rs. 1,000; I would not recommend reduction otherwise in the number of sub-heads that may be required under the principles laid down in paragraphs 658 and 659.

4,854. Heavy accounts work of Executive Engineers. The system of public works accounts and the changes necessitated therein by the amalgamation of the civil and public works account have been under consideration for some years. The whole matter was thoroughly discussed at a conference of accounts officers held in Calcutta in 1914, over which the then Comptroller and Auditor General presided, and the scheme drawn up as the result of this conference is now under the consideration of the Government of India, who are in consultation with local Governments on the subject. The scheme provides for saving of work in divisional offices in certain directions, e.g., reduction in the number of remittance schedules, abolition of several other schedules and statements, simplification of the cash and stock abstract books, elimination of establishment charges from the accounts compiled in divisional offices, and non-submission to audit of certain returns relating to accounts that can be examined locally at the annual inspections. The opinions of local Governments have been invited by the

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HON'BLE SIR REGINALD GAMBLE.

[Continued.]

Government of India in Finance Department letter No. 657-A., dated the 2nd August 1915, to which I would invite the attention of the Committee, and they have been informed that any suggestions will be considered. It will be observed that the local Governments were advised that the scheme should be considered by administrative and executive officers, with the assistance of an account officer, and this procedure has been followed generally. I have not yet seen the replies of the local Governments; but I understand that the majority have accepted the scheme, subject to such modifications as seemed to them desirable.

(2). The suggestions for a reduction of work, which have been offered to the Committee, are (i) the earlier closing of sub-divisional accounts, (ii) the Bengal scheme of a reduction in the number of returns rendered to audit, (iii) the placing of accountants in independent charge of divisional accounts, and (iv) a scheme of circle accounts as suggested by Mr. Milne. The complaints which these suggestions are designed to remove have not been very clearly defined, and it is difficult to offer an opinion as to whether they are, in regard to any particular points or with regard to the circumstances of any particular provinces, based on reasonable grounds. So far as I am aware, it is not the case in any province that the Executive Engineer is required to take more than a supervising part in the actual process of compilation. The rules in paragraphs 315-6, 370-2 and 1124, Volume I of the Public Works Department Code, are perfectly clear.

(i). *The earlier closing of sub-divisional accounts.*—One of the complaints referred to in the Committee's memorandum is to the effect that "during the period between the receipt of the sub-divisional accounts and the despatch of the complete papers to the central audit office, the whole of the divisional office staff has to be diverted from its proper duties to assist the accounts branch in order to enable the accounts to be ready on the prescribed date and that the speeding-up, which has taken place as a result of the amalgamation of the civil and public works accounts, has been to the detriment of executive work." I should have been able to examine this complaint more satisfactorily if I knew to which province in particular it has reference. The speeding-up referred to has, in some cases, reduced by a few days the time allowed (in the provinces in which there has been a change) for the compilation of accounts by divisional accountants; but, at the same time, the compilation work has been considerably simplified and reduced as already stated, and the cash and stock accounts of sub-divisional officers can be closed some days before the end of the month. In fact this question was very carefully considered by the accounts conference of 1914 and it was considered that the scheme of accounts already referred to did away with any cause for complaint on this score. In this connection I would invite attention to paragraph 1 of the pamphlet describing the proposed system of accounts. The trouble probably is due, to a great extent, to the practice, both in divisional and sub-divisional offices, of putting off the work of compilation till the last moment, instead of posting up accounts registers and schedules, as far as possible, from day to day as required by the rules. It is obviously desirable that transactions should be included in the government accounts as early as possible, but, if local Governments show that, in any particular cases, the proposed dates would cause serious inconvenience, the Government of India will of no doubt give due consideration to the matter.

(ii). *The Bengal scheme.*—This scheme has been working since 1912. It was fully considered at the accounts conference of 1914, and adopted in the final scheme to the extent that it was considered desirable. Certain books* and returns, which have been done away with in the Bengal scheme, are retained with some simplification in the final scheme which is now before the Government of India, because their retention was considered necessary, or advantageous both to the executive and to audit. In

view of the steps that have been taken to place this matter on a satisfactory footing, I do not think there is any fear of a scheme being introduced which will cause undue inconvenience to the executive. It may, however, interest the Committee to read the finding of the Accounts Committee of 1888-89 on the proposal to transfer compilation work from divisional offices to the central audit office. They condemned the proposal in paragraphs 418-9 of their report and this opinion was concurred in by the Government of India (Public Works Department Resolution No. 64-A, dated the 28th April 1890).

(iii). *Independent accountants in divisional offices.*—I would strongly oppose any proposals which would lessen the responsibility of Executive Engineers for their disbursements and the disbursements of their subordinates. The accountant cannot be made independent without necessarily reducing the responsibility of the Executive Engineer and opening the door to fraud. If, on the other hand, the intention is to make the accountant independent, not in respect of disbursements but in regard to the work of compilation only, the existing rules, which have already been quoted, provide for this in a large measure. A great deal is often made of the fact that the Executive Engineer is required to sign individually all the schedules which accompany the monthly accounts submitted to audit. This work does not require the expenditure of much time, but in paragraph 33 of the pamphlet describing the proposed system of accounts, already referred to, it is laid down that "Executive Engineers need not in future sign all the schedules accompanying the monthly accounts—it will be sufficient if they sign the Monthly Account—revised Form 27".

(iv). *Mr. Milne's scheme.*—Mr. Milne would centralize accounts work in circle offices under chief accountants, who would act as financial advisers to the Superintending Engineers. The scheme is not new. It was discussed and rejected by the Accounts Committee of 1888-89, vide paragraphs 412-19 of their report, and the Government of India concurred in this finding (paragraph 6 V of Public Works Department Resolution No. 64-A. G., dated the 28th April 1890). I entirely agree with the Accounts Committee that the proposal is unsuitable. While the Executive Engineer must necessarily continue to be responsible for the regularity of all his expenditure and the expenditure of his sub-divisional officers, the scheme would take away from his immediate control all the accounts of his sub-divisional officers and deprive him of important records, such as the Registers of works, contractors' ledgers, stock accounts, suspense schedules, etc., and also of the assistance of an expert accountant, with which he is at present able to fulfil his responsibilities. I cannot help thinking that the first people to cry out if they lost their divisional accountants, would be the Executive Engineers themselves.

The intervention of the Superintending Engineer for the purpose of compiling divisional accounts, does not appear to be desirable on any ground. In the first place, that officer is not in a position to exercise as close a supervision over works accounts as the Executive Engineer. Moreover, the Superintending Engineer has a large amount of travelling to do and is frequently absent from headquarters. The scrutiny of the works transactions would thus have to be left to a great extent to the chief accountant and this would not be satisfactory. A system of audit notes and half margin memoranda would necessarily have to be resorted to and instead of a reduction of work, there would probably be an increase. If, indeed, the chief accountant was to be an officer endowed with the qualifications and authority to scrutinise, on behalf of the Superintending Engineer, the technical details and other facts which audit has to accept on the certification of the executive, some good might perhaps be expected from the scheme, but such a proposal has not been made, nor is it considered feasible.

The scheme has no special merits, either from the audit or the executive point of view. It is unnecessary, therefore, to examine the question of cost. It is stated that the scheme would result in some saving to government, but even this would appear to be problematical.

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4,855. Unnecessary audit objections. It has been stated that the large percentage of expenditure under objection in the Public Works Department indicates that the existing rules do not work satisfactorily and that objections are sometimes raised as regards expenditure which a professional man would never question.

(2). This statement is not supported, so far as I am aware, by actual facts. I have analysed the figures of expenditure under objection for three provinces, (Bombay,

* Including Rajputana.

the United Provinces,* and the the Punjab) for 1915-16 and find that the percentage of the different classes of objections to the total expenditure is as follows:—

(1). For want of estimates	13.5
(2). For excess over estimates	5.5
(3). For want of allotments	13.7
(4). For excesses over allotments	3.0
(5). Miscellaneous irregularities	7.8
TOTAL	43.5

It will be seen that more than 80 per cent. of the total objections relate to the first four heads, in respect of which the audit is of an exceedingly simple character, being only a comparison of the figure of expenditure against sanction or allotment, and does not require any professional skill on the part of the auditor. Even under head (5), the majority of objections would relate to such simple defects as the want of proper sanction to the local purchase of European stores, or expenditure on contribution works in excess, or in anticipation, of the contributions.

(3). Objections regarding rates, or executive matters like a double movement of stores, should not be numerous, and, even in cases when such objections are taken, account officers have been instructed by me merely to make the necessary inquiries from executive officers but to refrain from showing the amounts as under objection. It has also been impressed on my account officers that meticulous and unnecessary objections should not be raised and if such objections are raised in some cases it is due to the fault of individual officers and not to the system.

(4). Objections under the first two of the five heads enumerated above are unavoidable in any system of audit and can only be reduced substantially if spending officers exercise due care to keep within sanctions and to obtain necessary sanctions expeditiously. A certain amount of reduction appears to be feasible under the third and the fourth heads, and this will be considered in connection with Mr. Tomkins' suggestion regarding the system of allotments. I do not think there is a case for a radical change of system.

(5). There is another side to this question which should not be lost sight of. While there are indications of some improvement, there is little doubt that there is still a want of regard by many Public Works Department officers of the financial rules laid down by the Government of India and the Secretary of State. A reference to my Audit[†] and Appropriation Report on the accounts for 1914-15 will show that there are certain classes of irregularities which are of constant occurrence. This is one of the principal causes of the large amount of work connected with audit objections both in executive and audit offices. It is the duty of audit to see that financial rules are observed and to raise objections when they are disregarded. If Public Works Department officers, instead of constantly transgressing the rules, were to observe them and duly realize their financial responsibilities, they would be spared a large proportion of the work which they now represent as being so irksome.

(6). A good deal has been made of the large amount of expenditure that is put under objection. I would place much more importance on the causes, than on the amounts, of the objections. It also appears that there has been a certain amount of irritation in consequence

of the term "objectionable outlay". Expenditure is not necessarily "objectionable", in the ordinary sense of the term, because it is placed under objection. The term has been abolished in the Civil Department and I propose to abolish it in the Public Works Department also.

4,856. Peripatetic audit.—The introduction of peripatetic audit has been suggested as a suitable method for reducing correspondence. I notice that the Committee have been informed that this system was once tried in Bombay and proved successful. In this connection, I would invite attention to Government of India, Public Works Department letter No. 47-A. G., dated the 8th February 1902. After the system had been given a four years' trial in Bombay, the Government of India decided that the experiment had not proved a success and the system was abolished. The reasons are given in the Government of India letter quoted and it is not necessary for me to repeat them.

(2). It is claimed for peripatetic audit that it would reduce correspondence and expedite the settlement of objections. Even this claim cannot be admitted, for our present experience shows that the annual test audit and inspection reports take a long time to dispose of and entail much correspondence. As regards personal discussions with Executive Engineers, it would probably not be feasible for those officers to be at headquarters for any length of time during the travelling auditors' visits, as they do not always find it possible to meet the accounts officer, even at the annual inspection. Moreover, as Executive Engineers are not officers in immediate charge of the execution of works or the custody of stores, they would not be in a position to answer off-hand the travelling auditors' inquiries and references relating to the initial accounts. Personal or official references to the subordinate officials, who are not all stationed at, or near headquarters, would often be necessary. Some sort of record of the audit results would in any case be necessary with a view to seeing that suitable action is taken.

(3). I may also mention that purely local audit appears really suitable only in cases like those of local funds and municipalities, where the work consists largely in the check of revenue with the detailed registers of demands, assessments, etc., and cannot appropriately be extended to large spending departments.

4,857. Detailed allotments for works. The question of altering the date of closing the financial year has been examined by the Government of India on several occasions, and it has been decided to make no change. Attention is invited to paragraph 2 of Public Works Department letter No. 705-A. G., dated the 16th October 1916 to local Governments on the subject. I understand that the Committee do not propose to re-open the question.

(2). I have carefully considered Mr. Tomkins' proposal to do away with the system of detailed allotments to Executive Engineers, and to place lump sums in the hands of the Superintending Engineers, who would be held responsible for their expenditure. It is claimed for this system that a large amount of correspondence in regard to reappropriations would be saved, that the present high expenditure in March would be obviated, that the number of audit objections would be reduced by about 50 per cent., and that the executive would be relieved of a large amount of petty detail and be able to devote a greater portion of their time to broader issues.

(3). The essence of Mr. Tomkins' scheme is that the Superintending Engineer should, in sanctioning estimates, give the Executive Engineer directions as to beginning the work or not, and as to the progress to be made, according to the funds available. The Executive Engineer has, at present, powers to sanction detailed estimates for works and repairs on his own authority (paragraph 321, Volume I, Public Works Department Code). Under this scheme, it would, therefore, be necessary for the Superintending Engineer to issue orders to the Executive Engineer as to the progress to be made in the case of all works in his circle, whether sanctioned by himself or by the Executive Engineer. I hardly think this would be practicable from the executive point of view.

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(4). If the Executive Engineers and their sub-divisional officers are working without reference to the funds provided they may very well spend, early in the year, more on not absolutely essential works than was provided for these works and then when retrenchment is called for, find either that they cannot retrench or that they can only do so by neglecting some really essential work, or by postponing the discharge of liabilities actually incurred. Sudden stoppage of works, which have been partially constructed, for which materials have been collected, or for which definite contracts have been entered into, is not likely to be in the best interests of the State. Superintending Engineers would find in actual practice that it is not easy to impose any check on expenditure unless they impose some limit on the Executive Engineers and they again on the sub-divisional officers. An Executive Engineer and his subordinates can properly regulate the outlay on the works under their control only if they know how much money they have to spend during the year; this would not be the case if they were simply told what portions of various works they should carry out. If officers were kept in the dark as to the allotments for their works they could not be held responsible either for excesses or lapses. This responsibility would then devolve personally on the Superintending Engineer, the officer most removed from the initial accounts, and he would have to conduct, in some other shape, the audit check which the audit staff can exercise, very easily and efficiently, in the ordinary course of the monthly audit of the divisional accounts. Mr. Tomkins himself realises this as one of the necessary consequences of his scheme, inasmuch as he proposes the amplification of the progress reports (which Executive Engineers at present submit periodically to Superintending Engineers) with a view to let the Superintending Engineers know monthly the progress of expenditure on each work, as also the estimated outlay of the following month. These reports are not submitted monthly in all provinces, nor are Executive Engineers required at present to show, either in them or in any other reports or accounts, the estimated expenditure of the next month on each work. It follows that Mr. Tomkins' scheme would involve, to a certain extent, the conversion of Superintending Engineers' offices into audit offices, and that there would, in this respect, be some increase of work in both Executive and Superintending Engineers' offices.

(5). Further, it is not clear how the transfer of the work and responsibility of controlling the expenditure against grants from Executive Engineers to Superintending Engineers, would by itself tend to prevent the rush of expenditure at the end of the year. It would still be necessary for the Superintending Engineer to regulate the expenditure within his circle according to the sanctioned grants of the year, and so long as this is the case, the change in the agency of control proposed is not likely to have any effect on the usual rush at the close of the year. The new system of re-grants of lapses of Public Works Department grants (paragraph 3.5 of Public Works Department letter No. 705-A. G., dated the 16th October 1916, already quoted), is expected to improve matters considerably.

(6). For these reasons, I have come to the conclusion that it would not be practicable, or expedient, to dispense with the preparation of a fairly detailed programme of works outlay beforehand and to do away with the present system under which the officer in charge of the division, and not the circle officer, is held responsible for exercising financial control over the expenditure on works. I also think that, except in regard to annual repairs, the estimates for which are prepared for the expenditure of each year separately, the sub-divisional officers should, in practice, be guided by money limits for each work, laid down by higher authorities. For repair estimates (annual as well as special) I think it is not altogether necessary to have individual allotments, and audit might well be conducted against lump sums for each of the three service heads, "Civil Buildings", "Communications" and "Miscellaneous Improvements" subordinate to the head "Civil Works".

(7). In regard to relaxation of audit check in the matter of allotments, a suggestion of a less drastic character than that put forward by Mr. Tomkins has been made to me, which would have the effect of reducing the number and amount of audit objections. I have not yet been able to examine the proposal carefully; but I intend to take it up and, if advisable, to bring it before the Government of India for consideration. In the meantime it seems hardly necessary for me to put it before the Committee.

(8). Under paragraphs 287 and 323-A., Volume I of the Public Works Department Code, local Governments can fix the powers of Superintending and Executive Engineers in the matter of appropriating funds. If full advantage is taken of these powers, there should be a reduction in audit objections and correspondence.

4.858. Advances to contractors. The suggestions made to the Committee are:—

(a). That the Executive Engineers should be empowered to sanction advances to petty contractors, in excess of the existing limit of Rs. 50 authorised by paragraph 780, Public Works Department Code, Volume I.

(b). That, in cases where contracts are given for finished work, the Executive Engineers should be permitted to make payments for materials required for such work and actually brought to site.

(2). As regards (a), the question is mainly an administrative one. Executive Engineers have at present powers to sanction advances up to Rs. 50 in any single case to contractors. This power is very seldom exercised in actual practice. There is no audit objection to increasing this limit to any small extent considered absolutely necessary in the interests of work, provided that necessary precautions are taken to safeguard government against loss. I may, however, point out that advances will be necessary only in the case of petty contractors who have not sufficient capital. But it is exactly in their case that the risk of losses due to advances becoming irrecoverable is greatest. It would therefore be necessary, if the system of advances is to be extended, to prescribe suitable rules for adjusting them expeditiously as work is done and paid for, for securing government against loss, and for guarding against possible abuses of the concession on the part of contractors.

(3). As regards (b) also, the essential point is to ensure that the system entails no undue risk of loss of government money. If contractors, whose agreement is for finished work, are paid in respect of materials collected and brought to site, precautions will be necessary to counteract any tendency on their part to postpone the actual execution of work and also to prevent possible losses due to shortage, misuse, or deterioration of the materials and the expense entailed on government for their proper watch and safe custody. This suggestion is, however, like the preceding one primarily an administrative matter and, if the concession is considered absolutely necessary in the interests of work, there would be no objection from an audit or accounts point of view. If it is decided to adopt the system, I would suggest that the necessary provision should be made in the forms of agreements to secure to government a lien on the materials paid for and also to safeguard government against losses likely to arise from the cause mentioned above. In fact the monetary help given should be treated, and shown in the accounts, not as payments made for the materials, but as advances made on the security thereof, the contractor's liability under the agreement being considered as discharged only on completion of the artificer's work, as stipulated for.

(4). In this connection I may invite attention to paragraphs 36 (b) and 43 (c) of the Audit and Appropriation Report for 1914-15, from which it will be seen that overpayments to contractors are not uncommon even under the present system and that such overpayments are not always recoverable.

4.859. Lump sum estimates for annual repairs to buildings. In the interests of efficient financial control, I think it is very important that detailed estimates should

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be prepared for all except very petty works. It is only when considering and sanctioning detailed estimates that the details of the proposed outlay come under the close scrutiny of responsible executive officers. The estimate is a record of these details for the guidance of the subordinate actually in charge of the work, while it is also valuable for future reference. In the absence of such a record, serious mistakes may be made in respect of specifications, rates, etc., and government may be put to loss.

(2). In the matter of annual repair estimates of buildings, the rules in the Public Works Department Code already allow considerable latitude to executive officers. Under paragraph 710, Volume I, Public Works Department Code, it is permissible to prepare a single repair estimate for a group of buildings of each class, instead of one estimate for each building; paragraph 716 allows the use of standard specifications, while the entry of measurements would also be facilitated by the use of standard measurement books as prescribed in paragraph 721. I understand that the facilities allowed by these rules are freely availed of in the Punjab where they appear to

* For specimens see annexures II and III (not printed).
have standardised forms* for annual repair estimates in which the rates, quantities, and cost of each kind of work are printed and clerical labour is thus reduced to a minimum. I am of opinion that the adoption of this procedure will secure the desired saving of work and that it is undesirable to introduce a system of lump sum estimates which will not give the sanctioning authorities, or the officials responsible for the execution of work, the opportunity of reviewing periodically the actual quantities of work to be done, or the rates and cost thereof.

4,860. Profit and loss accounts of workshops, stores and brickfields. The Accounts Department can, if desired, prepare regular annual profit and loss accounts, provided that the necessary data are furnished by the executive. I fear, however, that the collection of the data would throw considerable extra work on the executive, that in actual practice the preparation of the data would devolve upon subordinates, and that, in consequence, the results achieved might be misleading and unreliable. Moreover, to be of any practical use, the accounts would have to be prepared in great detail—i.e., a separate account for each workshop or brickfield, and for each stock depot, if not, indeed, for each class of stores in each depot—and this would create much work all round.

(2). As to workshops, the existing rules (paragraphs 1060—9, Volume I, Public Works Department Code) already provide for the maintenance of suitable accounts to show the financial working of the larger workshops. These rules could, if considered really necessary, be extended to the more important of the smaller shops, in respect of which it is desired to have periodical profit and loss accounts.

(3). In the case of brickfields, regular estimates are required to be prepared for the manufacture operations of each season. I think it is possible for the sanctioning authorities to determine in each case, after taking into account the extra charges like "interest" and "establishment" which do not enter into the accounts of manufacture, how the true cost of bricks manufactured departmentally would compare with the prevailing market rates. If this is sufficient for practical purposes, the preparation of formal profit and loss accounts for brickfields would hardly appear necessary. With reference to the observation that no allowance is made for the fact that the brickfields at times lie idle for years, I would invite attention to the rule in paragraph 1283, Volume I, Public Works Department Code, which would seem to cover such a case.

(4). In regard to stores generally, I think it would always be necessary for the Executive and Superintending Engineers, even if profit and loss accounts were prepared, to rely on their personal knowledge of the requirements of their works, of the availability, or otherwise, of funds for the purchase of stores at any particular time, of the

state of the stock and rates of the local markets, and of the various other factors in regard to which no *pro forma* accounts, prepared by the Accounts Department, would be of any use. It is in view possibly of such difficulties that the departmental rules (paragraphs 1203, 1270 and 1279, Volume I, Public Works Department Code) enjoin a great deal of personal vigilance on the part of the local officials, as well as the Superintending Engineers and local Governments.

(5). Another difficulty in regard to preparing profit and loss accounts of stores would be that an annual stock taking and valuation on a specified date by a responsible officer would be necessary. I am afraid this would be an almost insuperable difficulty.

4,861. Proposed levy by the Public Works Department of charges for the preparation of plans and estimates for civil departments. I would invite attention to articles 95 and 1006 of the Civil Account Code, which lay down the principles governing the classification and adjustment of charges incurred by one department of the state for services rendered to another. As the Buildings and Roads Branch of the Public Works Department is classed as a public service department, it would not be in accordance with accepted principles for that branch to make any charge to other departments for professional work done for them. It should be possible to devise administrative measures to check the abuse which is said to exist. A change in the recognised principles of classifying public expenditure does not appear to be advisable.

4,862. Powers of local Governments to waive or reduce charges for establishment on local fund and contribution works. Under paragraph 137, Volume I, and paragraph 1885-V, Volume II, Public Works Department Code, local Governments are empowered to sanction any relaxations of the ordinary rules regarding levy of establishment charges, in the case of works carried out by provincial establishment out of contributions and for local funds and municipalities. For want of time I have not been able to look into the history of this rule and examine the grounds on which it is based. I am not, therefore, in a position to give a definite opinion. But *prima facie* the theoretically correct course, from the account point of view, would be to require all establishment charges recoverable under the rules to be paid to the Public Works Department, any aid considered necessary being given to the local fund or body concerned as a regular grant-in-aid. If this course were adopted, the accounts would represent facts more accurately inasmuch as the charges on account of local educational, medical or sanitary schemes would no longer be classified in the public accounts as Public Works establishment charges. Moreover, there would be the advantage that each grant-in-aid would be duly considered on its merits. Some time ago it came to the notice of the Government of India that a certain local Government had issued general orders exempting all municipal and local funds from the percentage charges, and it was held that the general orders were not in accordance with the spirit of the rules.

(2). The foregoing remarks apply *mutatis mutandis*, to tools and plant charges.

4,863. Introduction of a system of pre-audit for presidency towns and large projects. The establishment of a separate pre-audit office for any project or group of projects at the same station must necessarily result in extra expense. For a single average project of the Buildings and Roads Branch, situated at a station other than the provincial headquarters, the cost of a separate pre-audit staff would obviously be prohibitive. Large projects like those for the buildings at Decca or Bankipore are not of every-day occurrence, and it would seem to be best to deal with each case on its merits.

4,864. Raising the limit for lumped sub-heads. I have already suggested in paragraph 4853(6) that, for the purpose of lumping petty sub-heads, the limit of cost might be raised from Rs. 500 to Rs. 1,000. I doubt if it would be advisable to raise it to a higher figure. In the case of projects of considerable magnitude, it might perhaps be convenient to have a higher limit, but such projects are not numerous.

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[Continued.]

ANNEXURE I.

Name of Division.	Year.	SANCTIONED IMPERIAL AND PROVINCIAL WORKS ESTIMATED TO COST.				
		Minor works.	Major works.			TOTAL.
		Below 2,500 to 5,000.	5,001 to 7,500.	7,501 to 10,000.	Above 10,000.	
Rawalpindi.	1912-13	274	26	-	-	-
	No.	300		10	4	18
	Cost Rs.	1,72,017		44,660	22,278	2,91,220
	330	5,33,175				
1913-14	340	33	-	-	-	-
	No.	373		8	9	22
	Cost Rs.	2,70,678		26,592	66,715	3,03,192
	412	6,67,087				
Amballa	1912-13	195	10	-	-	-
	No.	205		5	4	20
	Cost Rs.	1,10,848		24,392	27,028	2,43,399
	234	4,05,667				
1913-14	218	23	-	-	-	-
	No.	241		6	3	18
	Cost Rs.	1,54,331		26,422	15,876	2,53,668
	268	4,50,297				

The Hon'ble Sir REGINALD GAMBLE called and examined.

4,865. (President.) The witness stated that he was the Comptroller and Auditor General and that he generally supervised the accounts of the Public Works Department in that capacity.

4,866. He confirmed the remark in his written statement that "the object of the system of recording outlay by sub-heads is to enable the executive officer, to keep in touch with the progress of expenditure and to intervene, as early as possible, with a view to checking extravagance in rates and unnecessary outlay, or, in cases where excesses are unavoidable, to obtain the sanction of competent authority to revised estimates against which audit may be conducted," and stated that he did not think that executive officers could keep themselves in touch with the progress of recorded expenditure by merely taking the total amount of each estimate. A discussion ensued as to the practicability, or otherwise, of such a system and the witness finally remarked that the question was really one of financial control in which he, as an audit officer, was not very directly concerned although it was his duty as Comptroller and Auditor General to see that the financial interests of government were duly safeguarded. He emphasized the necessity for proper financial control by the executive spending department and said that, if Executive Engineers could satisfy government that they could exercise such control with fewer sub-heads or with an increased limit to minor works he would not object.

4,867. There was no objection from a purely accounts point of view to the increase of the present limit in excess of which sub-heads should be maintained for a work, and the increase of the existing limit for which particular sub-heads should be kept, provided Executive Engineers could satisfy government that they could exercise proper financial control over expenditure with the increased limits.

4,868. It was here suggested to the witness that, if the above was the case in regard to accounts, it might have the effect of relaxing the detailed budget control over the outlay on larger works. He was also informed that the view put forward in evidence by certain witnesses was that it would be distinctly to the advantage of the executive working of the Department if the limit of minor works were raised and officers given larger powers of expenditure. He stated in reply that such a course would undoubtedly result in having less items in the budget since a large number of minor items at present shown in detail in the budget would be included in the lump sum provision for minor works, and with their increased powers Executive Engineers would be able to spend the increased lump sum provision in whatever

manner they wished. He added that the question was more of an administrative than of an accounts nature. A reference was made in this connection to the figures of the Rawalpindi Division shown in Annexure I of the witness' written statement, with a view to illustrating the extent to which the lump sum provision in the budget would be increased in the case of that division if the limit for minor works were raised to Rs. 10,000.

4,869. It was pointed out to the witness, with reference to the statement in his written evidence that the question of the reduction of the number of sub-heads was carefully considered in 1888-89 by the Government of India in connection with the report of the committee on public works accounts and that the conclusion arrived at was published in the Public Works Department Circular No. 25 Public Works, dated the 29th October 1889, that that circular dealt with estimates and not with accounts since it contained specific reasons why estimates should be prepared in detail. He maintained that one of the points referred to in the Circular was the amalgamation of sub-heads and that the accounts followed the abstract estimates as defined in paragraphs 658 and 659 of the Public Works Department Code, except in cases of sub-heads of Rs. 500 or under (paragraph 1290); but admitted that the first sentence of the second paragraph of the Circular viz., "the preparation of an estimate in detail ensures that the responsible officer has given proper consideration to the requirements of the work, and is in possession of as much information as it is possible to obtain beforehand" did not primarily refer to accounts. He referred, however, to the second sentence of the same paragraph which read "the estimate also puts results on record for the guidance of a subordinate or successor, and for effective check over unauthorised outlay by a comparison of the work executed with the outlay incurred".

4,870. Asked whether accounts by sub-heads was the best method of controlling expenditure and whether expenditure could not be controlled at the time the contract was given, he replied that there was no necessity for the maintenance of sub-heads in the case of a purely lump sum contract (paragraph 753, Public Works Department Code), in connection with which no charges were incurred departmentally. Questioned as to whether the maintenance of sub-heads was necessary for piece-work contracts, he maintained that their abolition in such a case would introduce the danger of excessive payments, particularly as there was no guarantee that the accounts would not bring in charges other than those included in the contract. He pointed out that control exercised through a contract was a different thing from control over expenditure actually shown in the accounts.

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4,871. He could not say definitely why there were no representatives of the Public Works Department present at the conference of accounts officers held in Calcutta in 1914, as he was not then the Comptroller and Auditor General. But he presumed they were absent as the conference was purely one of the Accounts Department and as it was no doubt intended that all local Governments and executive and administrative officers should eventually be consulted.

4,872. The remark in his written statement that, so far as he was aware, it was not the case in any province that the Executive Engineer was required to take more than a supervising part in the actual process of compilation, did not imply that that officer was absolved from responsibility in this connection. The supervision by Executive Engineers of the work of their accountants involved a very important part of their duties. The prescribed examination of the books, returns, and papers from which the monthly accounts were compiled would be necessary even if the compilation work were transferred elsewhere. It involved a large amount of work, but there was no reason why the whole of the work should be deferred till the last few days. The signing of a fewer number of documents connected with the monthly accounts was a small matter and did not afford any real measure of relief to Executive Engineers, as their responsibility remained the same. He added that he was strongly opposed to decreasing the responsibility of Executive Engineers for the divisional accounts compiled in their offices.

4,873. The books and returns enumerated in his written evidence had been retained in the final scheme in addition to those maintained under the Bengal scheme as it was considered executive officers themselves would find it convenient to have these compiled accounts and as it was understood Executive Engineers in Bengal had kept some unauthorized accounts. At any rate, local Governments had been given the opportunity of examining the proposals and the result of their recommendations would be considered by the Government of India. He personally did not lay any great stress upon the inclusion of these particular compilation forms and would be perfectly ready to consider any proposals that might conduce to administrative convenience.

4,874. The witness adhered to his opinion that Mr. Milne's scheme for accounts officers under the Superintending Engineer was open to very great objections, apart from the fact that it would deprive Executive Engineers of their important records, e.g., registers of works, contractors' ledger, stock accounts, etc.

4,875. He was informed that the objections which had been urged by witnesses in regard to audit referred more to what he had in his written statement classified under miscellaneous irregularities, which formed a small proportion but which apparently bulked largely in the minds of Executive Engineers and that the only suggestion that had been made with a view to curing what had been termed "audit interference" was that the Audit Department should either employ a better class of clerks for raising the initial objections, or that such objections should be subjected to more supervision before they were forwarded to Executive Engineers. He replied that the suggested improvement in the class of clerks raised a very large question, and that he had all along recognised that the great desideratum was to do away with frivolous objections and that he had during his tours impressed on all audit officers the necessity for scrutinising every single objection before it was passed on to the executive officers concerned. These arrangements had had a tendency to lessen such objections, since small amounts objected to were now written off as a matter of course under the powers vested in audit officers.

4,876. He was opposed to the substitution of a peripatetic audit for a central audit, partly because the system had after a four years' trial in Bombay proved a failure and partly because of the great and unnecessary expense it would involve. In his opinion, the major portion of audit could be done much more conveniently and satisfactorily by a central audit office.

4,877. The objection in his written statement to the effect that the Executive Engineer had, at present, power to sanction detailed estimates on his own authority and that under Mr. Tomkins' scheme it would therefore be necessary for the Superintending Engineer to issue orders to the Executive Engineer as to the progress to be made in the case of all works in his circle whether sanctioned by himself or by the Executive Engineer, did not confuse technical sanction with the provision of funds, since the essence of Mr. Tomkins' scheme was that the Superintending Engineer should, in sanctioning estimates, give the Executive Engineer directions as to beginning a work or not, and as to the progress to be made, according to the funds available. It was pointed out to the witness that under Mr. Tomkins' scheme the allotments would be carried as far as the Superintending Engineer and no further, that the essence of the scheme appeared to be that the Executive Engineer would receive a list of works to be carried out during the year, that the latter would be entitled to carry out those works according to the requirements and best interests of the Department and that he would not be bound down to specific allotments for each work, and inquiry was made as to what accounts objection there was to such a procedure. The witness contended that difficulties would probably arise with the different heads of departments since the Executive Engineer might spend more for one department than for another and that there had actually been trouble in the past in this connection. Such trouble would not be the result entirely of favour shown to a particular department, as the Executive Engineer might find it more convenient to spend more money in one locality than in another with the result that he might disappoint some heads of departments. This particular matter, however, was more an administrative than an accounts question.

4,878. The remark in his written statement that sub-divisional officers should, in practice, be guided by money limits for each work, laid down by higher authorities, was made with reference to Mr. Tomkins' suggestion that the sub-divisional officer should have only working instructions given to him for his guidance. Without such money limit, it would be almost impossible to carry on works, particularly as it might result in serious loss, if the Superintending Engineer were to intimate that he had not the money to spare for a work which had already been begun.

4,879. Although Executive Engineers had not been given powers of reappropriation, it appeared to him that, as local Governments were competent to delegate powers of appropriation to Executive Engineers under paragraph 323 A of the Public Works Department Code they were competent also to delegate powers of reappropriation. It was hardly within his province to suggest what powers should be given, but from a purely audit point of view audit would be satisfied simply to audit against powers given. It was desirable that local Governments should give Executive Engineers powers of reappropriation under defined limitations, particularly with regard to small works.

4,880. (Sir Noel Kershaw.) The question of the grant of advances to contractors was purely an administrative matter. There was no objection from an audit standpoint to the grant of advances when necessary; the main point was to safeguard government against loss.

4,881. The payment for materials actually brought to site was open to the danger that contractors might do such portions of work as paid them best and leave the rest undone.

4,882. (President.) The witness was informed that the taking of detailed measurements for the payment of bills entailed a great deal of unnecessary labour and that Executive Engineers had stated in evidence that it would greatly facilitate work if they were allowed to make payments well within the limit without detailed measurements. He was asked whether there would be any objection to payments on account being made on the certificate of an officer that a certain amount of work had been done without detailed measurements, subject to such measurements being taken when paying finally

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for a work, and in reply he stated that there would be no objection from an audit point of view.

4,883. The standardized forms in use in the Punjab for annual repair estimates were printed locally and brought together all the details before the sanctioning authority every year. It was understood that the printed entries were altered to incorporate any changes. The petty items in the estimates were simply a lump sum percentage.

4,884. No numerical accounts were submitted to audit in the Civil Department for the purchase of office furniture, but they were necessary in the Public Works Department owing to office furniture being classified as tools and plant in the case of divisional offices, vide paragraph 339, Public Works Department Code. There would be no audit objection to all classes of office furniture being treated as contingencies instead of tools and plant.

4,885. Asked whether it would be feasible to maintain profit and loss accounts in order to show whether government was justified in maintaining its own brickfields, instead of going to the open market, and whether such accounts could similarly be kept of the stores stocked by the Public Works Department, he stated that, as mentioned in his written statement, such a practice could be introduced, but it was a question whether the amount of labour involved and the results that could be obtained would be sufficient to warrant it. He added that, in his opinion, the advantages of such accounts would probably not be worth the trouble of their compilation.

4,886. With regard to the suggestion that a fee should be levied by the Department for the preparation of plans and estimates for other departments, with the object of checking the tendency of calling unnecessarily for plans and estimates, he was of opinion that, as the Building and Roads Branch was not a quasi-commercial department within the meaning of Article 95 of the Civil Account Code, it was not entitled to make such a charge. The matter he thought was one which called rather for executive action. He suggested that, if it were laid down that the sanction of higher authorities had to be obtained before the Public Works Department could be called upon to prepare plans and estimates, it would be a check on the present tendency.

4,887. The view expressed in his written statement that the remission of departmental charges was open to objection in principle was his personal view. He had

not however had the time to examine the history of the question. He was not prepared to say that the Government of India were wrong in delegating these powers. He considered that from a purely accounts stand-point it would be advantageous to levy the charges. The amount involved was likely to be overlooked when given in the form of a remission of the charges, instead of by a regular grant-in-aid.

4,888. (Sir Noel Kershaw.) The system of peripatetic audit had been in existence in Bombay for a period of four years and had reference, with minor exceptions, to the entire province. It was admitted in Bombay to be more expensive, and its disadvantages outweighed its advantages. Peripatetic audit sometimes enabled an audit officer to interrogate officers on the spot, but it was more or less difficult to question sub-divisional officers, who were disbursers, and Executive Engineers, owing to their being sometimes at a distance from headquarters at the time of audit. There was an advantage in examining such officers personally, whenever feasible, and in the local audit of receipts and some classes of expenditure, but a peripatetic audit was very costly. He would not allow the cost of peripatetic audit, unless it was considerable, to influence its introduction, but he did not think that the system had any great advantages as far as the Public Works Department was concerned, particularly as it would not result in any material reduction of work in the divisional and sub-divisional offices. If peripatetic audit were undertaken otherwise than monthly it would only be a test audit and a great deal of expenditure would not come under audit; at present all expenditure was audited. Advantage was taken at the present annual inspections of examining questions which had arisen during the monthly audit.

4,889. The maintenance of a yearly or triennial profit and loss account of government brickfields would, so far as the work involved was concerned, practically amount to one and the same thing. But if at any time it was considered necessary to inquire into the profit or loss of a particular brickfield, the Accounts Department could draw up a skeleton form on data supplied, for the guidance of the executive.

4,890. (Rai Bahadur Ganga Ram.) The question whether the additional charge of 10 per cent. prescribed in paragraph 1222 of the Public Works Department Code for the sale of stores to the public or other departments had the effect of accumulating unnecessary and useless stock was really an administrative one.

ALFRED CHATTERTON, ESQ., C.I.E., D.S.O., A.C.O.I., A.M.I.C.E., M.I.M.E., Controller of Home Indents and Priority.

Written Statement.

4,891. (VIII.) Education and (VIII.) Practical training.—The principal point which I would wish to bring before the Public Works Department Reorganization Committee is in connection with the training of engineers in this country. From 1888 to 1901, I was Professor of Engineering in the Engineering College, Madras, and since I relinquished my connection with that institution, I have had considerable experience with engineers trained in this country employed on work of a somewhat different class to that which usually falls to the lot of the average Public Works engineer. As Director of Industries both in Madras and in the Mysore State and as a Member of the Indian Industrial Commission, I have had many opportunities which have enabled me to arrive at the conclusion that one important cause of the backwardness of Indians in industrial matters is due to the defective and inefficient system of training mechanical engineers which has hitherto prevailed in this country.

(2). There are three classes of men required, for whose training provision ought to be made: (1) mechanics or workmen, (2) mechanical foremen and (3) mechanical engineers. Hitherto, the education of mechanics has been provided for in institutions like the engineering schools at Nagpur, Amraoti and Bankipore; but the main training ground is in large railway and government workshops and in private engineering works. The schools turn out men with a fair knowledge of their trade but

totally unacquainted with the life of a workshop and generally they consider themselves vastly superior to the ordinary shop-trained men and usually they find it difficult to settle down in a workshop alongside such men. The result is that comparatively few of the school-trained mechanics stick to their trade. On the other hand, the shop-trained men are generally not very well educated, have little knowledge of drawing and are unable to adapt themselves readily to new lines of work. It would be well if we could abolish the training of artisans in engineering schools altogether and provide a certain amount of elementary technical instruction for workmen in the larger engineering works. This could be done by the establishment of a regular apprenticeship system and compelling all the apprentices to attend night classes. For the training of men who may subsequently hope to become foremen, very little has been done in this country and most of the larger workshops import their foremen from Great Britain. Till the workmen are better educated, there is very little hope that any large number of them will be fit to be promoted to such posts as chargemen and foremen of shops. In a number of engineering schools such as the Chengalvaroya Naicker's Technical Institute in Madras, the Mechanical Engineering Schools in Mysore and Lucknow and in the subordinate branch of the Sibpur Engineering College, attempts are made to train a class of men who will ultimately become foremen and assistants in large engineering shops. So far, the ex-

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periments in this direction have not met with much success and most of the students turned out have eschewed large engineering workshops in which they might get good practical experience and have taken up small jobs such as looking after cotton-ginning factories and other small Indian power-driven factories. In the engineering schools, the idea is to give an all round training in the various engineering trades simultaneously with instruction in drawing and in the elementary principles of science which find application in mechanical engineering. The course usually lasts three years and the pupils are then expected to complete their practical training in workshops, where it is intended that they should specialize. If they would do this and if they did not enter into the workshops with a swollen head, the majority would, after a few years' practical experience, become really useful men and capable of being placed in positions of control. Experience so far does not seem to point to the desirability of greatly extending such a system of training foremen and it seems necessary to make arrangements by which modern liberally educated youths can be sent from school direct to work-shops. In some places, it will be possible to provide evening schools somewhat similar to the English polytechnic schools; but generally, the situation of engineering works seems to point to the necessity of introducing a sandwich system of training, whereby each boy spends from 6 to 8 months in the year in the shops and from 4 to 6 months in a school situated in a large centre of population where provision can be made for a scientific and technical training.

(3). There are four engineering colleges in India and all of them primarily train men for the Public Works Department. In recent years, more attention has been paid to mechanical engineering; but even now, it is quite inadequate. I should like to draw attention to the evidence of Mr. T. W. Tutweiler, the General Manager of the Tata iron and steel works at Sakchi, which he tendered to the Indian Industrial Commission at Calcutta at the end of last year. He says, "I do not think we can get Indians to replace foreigners in the higher positions in the industry with which I am connected until the Indians are sent abroad and trained. It seems to me that too much value is attached to the importance of receiving a University education in this country. A good education, I firmly believe, is necessary, but it is not an essential thing that a man has to go to a University to make a good and efficient workman. If an Indian desires to take up an industrial career, instead of continuing his education until he is 22 or 23 years of age and then expecting, because he has received that education, to commence his industrial career at the top of the tree, he should make up his mind what particular kind of industry he desires to go in for, leave school at about 15 or 16 years of age and become attached either as an apprentice or workman for a period of years. This period would be invaluable to him for more reasons than one for he would get the opportunity of making a skilled and efficient workman equipped with a knowledge of that particular trade or industry which has to furnish him a livelihood, while, on the other hand, it gives him an opportunity of discovering whether his selection of an occupation has been wisely or unwisely made. During this time, he could with great advantage continue his studies in his leisure time on the theoretical side of the industry, and at the expiration of his apprenticeship (if circumstances permitted) two or three years in a European country would enable him by association with modern and up-to-date practice to attain the same degree of efficiency as the European."

"Under the present conditions of Indian labour, although the European element has in our works been greatly reduced, I feel that it will be necessary to have European supervision and direction until such a time as the Company picks out youngsters and sends them abroad, making arrangements with some of the foreign firms to take them into their works and make them start at the bottom and go through the school of hard knocks. I suppose you will ask the question why we cannot train

Indians here for the higher positions instead of sending them abroad and my answer to that is this. I will not say Indians cannot be trained here for the higher positions but in my opinion, if Indians are sent to foreign countries before their habits in life are formed and before they are too old to be influenced by home ties and religious scruples, they will enter upon their work in a freer atmosphere and will see other young men, their equals in social status, beginning at the bottom and working up and it is my opinion that to become efficient in any department of the iron and steel industry and to be able to teach others, it is absolutely necessary that they should go through every stage of the process. I do not think that Indians of the type who would make superintendents or heads of departments would be willing to go through this course of training in this country as they would feel that their social status would be lowered by doing the work of menials which they would have to do if they began at the bottom. When this is done, the iron and steel industry will be more firmly established in this country."

Whilst I agree with Mr. Tutweiler as to the reasons for the failure of Indians as mechanical engineers, I do not think that the remedy which he proposes is capable of more than a very limited application and it will be better to provide for a radical reform in the conditions under which engineers will be trained in the future.

(4). The four engineering colleges in India train students intended ultimately to become officers in the Public Works Department, the railways, district boards and private firms; but these are few in number compared with those attending the classes for instruction of upper subordinates, lower subordinates, draughtsmen and surveyors. The arrangement is not a satisfactory one as there are obvious disadvantages in providing, in the same institution, for the training of both officers and men. In Madras certainly and to a large extent, I think, in the other engineering colleges, the education of engineers has been too much influenced by the needs of the Public Works Department and consequently framed to suit its immediate requirements without regard to the future or to those other interests in India which can only be handled by engineers. Undue importance is attached to surveying and to descriptive engineering whilst mechanical engineering has been greatly neglected. Personally, I hold the view that every engineer should first be trained as a mechanical engineer and that specialization in one or other of the various branches of engineering should only begin after a good foundation has been obtained by the study of mechanics, the mechanical sciences, drawing and workshop practice.

(5). I understand that even now guaranteed appointments in the provincial Public Works service are still offered as prizes to the students in the engineering classes of these colleges and doubtless they help to attract students to the engineering profession. The training given in the engineering classes is supposed to fit the students for appointments as officers; but actually only a comparatively small percentage get admission in the officers' grade and the rest find employment in comparatively subordinate service or in private employ. There seems to be a great waste of effort in giving to a large number of students, who will subsequently never rise out of the ranks of subordinates, the kind of training which is only necessary for men who aspire to ultimately attaining the very highest positions open to engineers. This leads me to suggest that one engineering college for the whole of India will at present amply supply the needs of the country and the existing engineering colleges can be reorganized so as to provide courses of training better suited to the careers which the great majority of the students will ultimately follow.

(6). The association of the engineering colleges with the university system of the country has led to the prescription of university tests for admission to the engineering colleges. I can only speak with detailed knowledge of Madras and there for many years students were only admitted to the engineering college in the engineering class after they had passed the B.A. degree examination. Some years ago, the test was lowered to the first arts

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examination and I think this was done as a compromise between the plan which I suggested and the then existing practice. I think there is no doubt that the education of an engineer should begin at a much earlier stage than is possible if it is in any way connected with the university system. The boy intending to be an engineer should begin his special course of studies in his 17th year. At that age, he is hardly likely to have completed his general education and his command of English will not be sufficient for one who hopes to rise to high positions afterwards. The engineering college or school which he enters should therefore provide for instruction of a practical character in English, mathematics, the physical sciences and in mechanical engineering. Mathematics and physical science should be taught in close relation to the study of mechanics and the laboratory work should be designed to illustrate their practical application. There should be suitable workshops in which he should spend at least two days a week under normal workshop conditions as regards the hours of attendance. At the end of two years, the process of differentiation should begin. The boys, and they will probably be the great majority, who, through force of circumstances, have to begin to specialize early, will either proceed to a further two years' course in the same institution in civil engineering, which will complete the education necessary for those who ultimately expect to rise to the highest position possible to men who begin life in this country as upper subordinates, or they will go out and become apprentices for a period of not less than three years in engineering workshops, which should fit them for employment in industrial factories or workshops, where their prospects will depend on their own capacity and determination. Those students whose position in life renders it possible for them to attend a more prolonged collegiate course or those whose mental capacity renders it desirable that they should receive a more advanced training would go on, either at their own expense or with the assistance of scholarships, to a higher grade institution, where opportunities for study would be given equal to those of the best colleges in Europe and America. The course should extend over a period of not less than three years and should be devoted to the training of civil, mechanical and electrical engineers. There, as in the earlier stages of their training, particular attention should be paid to mechanical engineering and only in the last two years should specialization become intensified. The extent to which provision should be made for general education must be determined by experience, having in view the fact that the students leaving the college should in no way be deficient in mental capacity or attainments when compared with university students of the same age.

MR. ALFRED CHATTERTON called and examined.

4,892. (President.) The witness stated that he had been professor of engineering in the Madras Engineering College from 1888 to 1901; that he had been Director of Industries both in Madras and in the Mysore State, and that he was a member of the Industrial Commission. He was at present the Controller of Home Indents and Priority.

4,893. He considered that the ideal system for the training of mechanics and workmen in India was to establish an apprenticeship system and to start night schools for the apprentices but feared that, in most cases, this would be impracticable, the conditions being such that apprentices were too tired at the end of the day to be able to put in two hours at a night school. The system had been tried in Madras, but the only people who attended the night schools were clerks of the Board of Revenue who wished to gain some elementary knowledge of engineering. This system used to be very popular in England but he could not say how it was progressing at present. About five years ago a scheme was put forward in Madras for the establishment of an apprenticeship system under which apprentices were to be taken into the various mechanical engineering workshops, government providing a school in the neighbourhood. Most of the employers agreed to let apprentices go there

(7). I am convinced that a single college for all India will for some time to come adequately meet the needs of the country. I consider that it will be better to extend laboratories and workshops, to sub-divide departments and to create new departments rather than to establish additional colleges. It has been suggested to me that such a college would only attract students from the province in which it might happen to be started but that is not the experience of the Indian Institute of Science in Bangalore, to which students freely come from all parts of India and there has never been in it an undue proportion of South Indian Science students. It is well known that students now freely go abroad in spite of the fact that it involves separation from their families and friends for a long period of time. The central engineering college that I contemplate might start by admitting about 50 students a year and be gradually increased till the number of annual admissions reach 200 which would mean, making allowance for those who dropped out on the way, that ultimately provision would have to be made for the training of some 550 students at one given time. By concentrating the higher engineering teaching of the country in a single institution, it will be possible to provide it with a staff of men of the highest eminence and to provide facilities for research work of the kind needed in connection with engineering problems of a peculiarly Indian character.

(8). I am of opinion that Roorkee with its already great tradition as a centre of engineering education might be converted into the imperial college. The climate is suitable, the existing buildings could be very largely utilised and the fact that it is not in a very central position is a disadvantage of a very minor character. It seems to be unnecessary to go into details regarding the training which should be given in this college; but it is necessary to point out that the mechanical engineers would still need a period of workshop practice under ordinary factory conditions. In the college, the students should be taught to recognise the limitations of their college training and the necessity for practical experience. The difficulties mentioned by Mr. Tutwiler in getting the educated men to work with their own hands in the workshops would then largely disappear and the student would be prepared to accept the workshop course as part of his training. It is essential that the student should be so prepared that he will go through it in the proper frame of mind to take advantage of the experience it offers. With the previous training in the college, this workshop course need not be a very long one. He would enter upon it with a fair degree of manual skill and should be in a position to rapidly accustom himself to manufacturing conditions.

for two or three afternoons a week. The witness was not, however, sure whether the scheme had been carried out or not.

4,894. In regard to the training of mechanical foremen he deprecated the training given in the colleges but explained that the remarks to that effect made in his written statement had reference only to mechanical foremen and not to overseers in the Public Works Department. One of his main contentions in regard to the training of civil engineer subordinates was that, with the exception of those employed purely on survey work, they would make better engineers if they had more mechanical training either in the college or school, or in a workshop. He considered that mechanical engineering was the basis of all engineering work and thought that a man became a better civil engineer by virtue of the fact that he had received a certain amount of training as a mechanical engineer. He recommended therefore that the first two years in every engineering college should be spent by all students on mechanical engineering. In all the engineering colleges in England the students had to learn a great deal more mechanical engineering than in India. He admitted, however, that he had no recent information about the system in England but up to the time to which his knowledge extended he was certain that

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practically every engineering student had to take up mechanical engineering to start with, civil engineering being taken up at the end of the course.

4,895. The witness admitted that some colleges had specialized courses in particular branches of civil engineering and that students in those colleges could take up such courses without first going through a course of mechanical engineering, but all colleges which gave general training such as, for instance, the City and Guilds of London Central Institute, Leeds, and most of the Universities in the North of England, imparted instruction in mechanical engineering, both theoretical and practical, as well as in applied mechanics, mechanical drawing, workshop practice, strength of materials, etc. He was therefore strongly of opinion that in all the engineering colleges in India the mechanical engineering and workshop training should absorb a substantial portion of the time of a student, particularly in the first two years.

4,896. An alternative to the course above recommended was that a considerable proportion of the time now spent in lectures on descriptive engineering might be reduced, as this could be better acquired outside. The first thing required was to train a student in the fundamental subjects that underlay the whole profession. In India the student joining a school or college had generally not learnt to work with his hands, and was thus totally unable to appreciate what manual work meant. For a man to judge the value of "work" it was desirable that he should be able to do it himself, as it was very difficult for one who had never worked himself to say whether a workman was slack or not, and whether the work done was of good quality. The workshop training was even more important in India than in England as an Indian going to an engineering school was, unlike an Englishman, unaccustomed to the use of his hands. A boy in India never had a box of tools while an average English boy was generally a bit of a carpenter. Primary and secondary education in England also included more practical work than in India.

4,897. He recommended that students of the engineering colleges should not be admitted at a later age than 17, and that a certain amount of general education should be given in those colleges. He had had a good deal of experience and was of opinion that the aim should be to get a man into the atmosphere of practical work as soon as possible, as the University courses were primarily designed for the production of clerks, pleaders, etc., and hence the students who went in for the higher University course had their faculties developed in directions which were useless in the case of an engineer. An attempt should be made to pass boys directly from the high schools to the technical college, and if necessary to give them a more general education there. The witness was not against but strongly in favour of giving liberal education to engineering students, only he desired that it should be given in the engineering colleges under conditions which would be favourable to the development of engineering instincts. For instance, a University student had to learn a vast amount of English philology which was of no practical use to engineering students. The study of Chaucer, logic and psychology provided for in the University courses, though useful as a training, was of no great value to an engineer. He did not agree with the objection put forward that an engineering college in India was not the right place for general education, and that such education should be completed before a student commenced his course of study in such a college.

4,898. He would as an exceptional case relax the age-limit of 17 in the case of sons of contractors who had worked with their fathers and gained experience on practical works and then desired to join the engineering colleges, but maintained that as a rule such men were more desirous of going through a University course. If, however, a boy started early in life working with his father he would hardly have time to get much general education and would be in the same difficulty in regard to general education at 22 as at 17.

4,899. He recommended a two years' general course for all students, to be followed by a two years' special course in the case of upper subordinates and by a three

years' course in the case of engineers. The particular point upon which he desired to lay stress was that at present government was training a large number of men as engineers who never rose beyond the rank of upper subordinate. He considered therefore that it would be better to differentiate at the end of the first two years between men who were going to remain as upper subordinates and men who hoped to get appointments, either private or government, as engineers, and to rise to higher posts in government service or in the profession. He did not agree with the view that it would be better to have separate courses from the very beginning for upper subordinates and engineers, and explained that although in Madras there were separate classes the students of both classes belonged to the same social rank. The cleverer boys went into the engineering class and the others into the upper subordinate class. He considered that, if boys were admitted at the age of 17 as proposed by him, a large number of them would not turn out satisfactory engineers, although they might make good subordinates, but if they were trained together for the first two years it would then be possible to select suitable candidates for the superior ranks, and these could be sent to the more advanced imperial institution, the establishment of which he advocated, while the others could be educated in a provincial institution. He was of opinion that instead of four or five colleges for the training of engineers there should be one big institution where it would be possible for government to maintain a larger and more efficient staff than it was possible to do in the provincial institution. He did not object to the training of lower subordinates in the same institution with upper subordinates, but he objected to the training of officers along with subordinates. His remarks to that effect in his written statement had particular reference to the Madras college where all the four classes of students, engineers, upper subordinates, lower subordinates and draughtsmen were trained in the same institution. He recommended that upper subordinates and engineers should be trained together for the first two years as they would be in a way completing their general education during that period, but considered that, after these two years, it was essential to make a differentiation, and that engineers and upper subordinates should then be trained altogether separately.

4,900. He recommended that there should be one high-grade college for the whole of India instead of the existing provincial colleges. He had not seen the objection to this proposal put forward by the Atkinson-Dawson and Public Services Commissions, but in discussing the question he had found no adequate reason against the proposal. He did not see that there was any force in the objection that one institution, unless it was a very large one, would not be able to instruct the ever increasing number of students pouring into the colleges, as he was of opinion that the number of students to be trained as engineers should be very much reduced. At present the number of persons getting appointments as engineers was only about 20 a year and he considered that in Madras too large a number were being trained as engineers. The provincial colleges could provide for the training of upper subordinates, as well as persons to be appointed as local fund or municipal engineers, but the central college would be designed to turn out the best type of engineer and to impart training equal to the best afforded in England. It would be a great advantage for instance if each year three or four of the best students of the Madras college could be sent to a central college and these be enabled to get a higher and more practical training than they could get at present.

4,901. The second objection that the central college would attract students entirely from the province where it was situated and would handicap students from the other provinces had also not much force in it. He had practical experience of the Institute of Science at Bangalore which attracted students from all parts of India, and even more from Upper India than from places close by. He admitted that the boys joining this institute were

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between 21 and 22 years of age and that the boys joining the central colleges would be about 19 years of age, but considered that there would be no difficulty on that score as boys at that age were found to be going to Japan, America and England for education. He was absolutely certain therefore that there would be no difficulty in getting students from the distant provinces and was of opinion that the prestige of the central college being under the Government of India would be sufficient to attract suitable students.

4,902. He had also considered the objection that the central college might degenerate into a provincial college but had made the proposal on the assumption that there would be a central organization of the Government of India to control it.

4,903. He was of opinion that engineering colleges should not be affiliated to the Universities and should have nothing whatever to do with them. His opinion was based on his experience of the Madras college. There the curriculum was drawn up by practical engineers, and the students were trained accordingly. The University also granted the degree of B.E. and prescribed a certain syllabus of studies which corresponded on certain points with the college course but differed considerably in many instances. The students had to get a diploma from the college and had also to obtain the B.E. degree from the University. They were, when he was at the college, examined in December for the college diploma and again in January for the University degree. In the first place there was no necessity whatever for these two examinations by independent boards of examiners, and secondly, where the University course differed from the college course, it was generally to the disadvantage of the University course. The whole of the control, so far as the University exercised any control, was by men who had very little experience of engineering work. The Madras college was fairly closely connected with the Public Works Department which had a good deal to say in the original drawing up of the curriculum and the students gained no advantage from the work prescribed by the University. As time went on changes were introduced in the college course but none in the University course, as it was a comparatively simple matter to get government to sanction a change in the curriculum of studies but it was a matter of years to get any change from the Senate of the University who took little interest in the college. There were about a hundred men on the Senate very few of whom were engineers belonging to the engineering Faculty. Madras had thus derived no benefit whatever from the affiliation of their engineering college to the University. Nor did he think that affiliation had any effect in regard to, attracting students; the real attraction being the guaranteed appointments. The degree of B.E. might possibly attract students in Bengal, but on the whole he considered that a central institution under the Government of India would have a much greater attraction than any provincial institution could possibly have.

4,904. As regards the staff of the colleges, he was strongly in favour of a kind of sandwich system under which a man put in a certain number of years in an engineering college and a certain number on practical work in the country. He would rather see teaching of a less highly theoretical character but carried out by practical men. Recruitment direct from England brought out a class of men with considerable theoretical knowledge and possibly a good deal of practical experience as far as English practice was concerned, but their ignorance of the conditions under which engineering was carried on in India rendered their teaching work of considerably less value than if they had had a certain number of years' practical experience in the country. He would like to see Public Works Department officers deputed to the college but the difficulty he anticipated was that of getting the best men to volunteer. If, however, Public Works Department officers could be induced to take up teaching work for two or three years at a time he would certainly prefer to have a man of that type to a man who had never had any practical experience of engineering in India.

4,905. He considered that there was a good deal of justice in the criticism offered to the Committee that the engineering colleges were in general over equipped, that they were provided with machinery on an extravagant scale, and that what was required for an engineering college was a fairly large number of cheap machines which the students could use and handle rather than the more expensive types. There was a tendency among the professors who came from England to buy a lot of machinery and apparatus which were not really required and the demand for which was dictated more by English than by Indian requirements.

4,906. The question whether the engineering colleges should be allowed to take up research and testing work for the public depended mainly on the staff that was available and upon their qualifications for the task. He did not think that there were many Indian students who could do anything in the way of research and considered that even if they were allowed to do so they would be wasting valuable time which could be better spent in going through their ordinary course of instruction. As regards the professors, however, especially if they were brought from England and had no practical knowledge of the country, the more special Indian engineering problems they had to tackle the better it would be for the professors themselves and ultimately for the students, as it would help to bring them into contact with the engineering conditions of the country. The witness had himself started the first testing laboratory in connection with a college. He did not therefore agree with the opinion expressed before the committee that testing work was outside the scope of an engineering college, as there was a considerable amount of valuable work that could be done in the college, and though students might be unable to undertake the work themselves they would derive considerable benefit by seeing such tests carried out.

4,907. (*Rai Bahadur Ganga Ram.*) He suggested that the course for upper subordinates should be one of four years and for engineers one of five years so that a student joining at 17 as proposed by him might leave as an engineer at 22. This would include two years during which general education would be imparted in the engineering college.

4,908. (*Mr. Cobb.*) He doubted whether the Public Works Department men would be willing to join colleges as teachers. The other system of recruiting teachers was one of which he had practical experience, having himself adopted it. He came out to India as professor of engineering without any previous knowledge of Indian conditions and managed to get attached to the Public Works Department for two or three years, a fact which was of the greatest advantage to him as a teacher. The proper course therefore would be to lay down the condition that men recruited in England would be posted to the Public Works Department for short periods in order that they might acquaint themselves with Indian conditions. In cases where young men were recruited there would be absolutely no difficulty in giving them a couple of years' experience in the Public Works Department as Assistant or Executive Engineers.

4,909. He did not contemplate that the central institution should do anything in the way of training teachers. The idea underlying his proposal was that government would be able to get men from the Public Works Department in India who combined high scientific knowledge with a considerable amount of practical experience and who would be willing to take up positions in the central college though they would not be equally ready to accept appointments in a provincial college.

4,910. He had not had sufficient experience of the requirements of the Public Works Department within the last ten years to be able to say whether the training in the colleges was adequate. He had been in close touch with mechanical work and had found that the engineers produced were wanting in knowledge of mechanical engineering. He felt that the real requirement of India was a large number of engineers with a sound training in mechanical engineering and was of opinion that the industrial development of the country was greatly re-

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[Concluded.]

tarded on account of the paucity of good Indian mechanical engineers. Both first and second-class men were required at present as one seldom came across an Indian mechanical engineer holding a position of responsibility in a workshop. The central college would, he thought, be in a better position to meet the demand in this respect than the existing colleges.

4,911. He was of opinion that the mechanical engineers produced by the engineering colleges were neither sufficiently trained in theory nor did they have sufficient training in practical work. The Indian engineering colleges were originally organized to meet the requirements of the Public Works Department, but the conditions had since changed and a large number of mechanical engineers were now required to meet demands outside the Public Works Department. It would not be necessary for all such men to go to the central college and a considerable number of the second-class men could be trained in the provincial colleges.

4,912. (Mr. Mackenzie.) The question as to which students should become engineers and which should remain as subordinates would depend in most cases on the students themselves, as it would have to be left to them to say whether they wanted to go through a further course of instruction in the provincial college or intended to go to the imperial college for higher study. In a considerable number of cases the decision would depend on whether a student could afford the necessary expenses. He did not agree that the decision in such cases should rest with the principal of the college and would prefer to leave it to the students themselves since they were the best judges of their own capacity and of the prospects that lay before them. If they found that they were unable to take advantage of the higher courses of study which he would provide for engineers, they would be content to occupy humbler positions. He suggested that the local Governments should give a certain number of scholarships to brilliant students from each provincial college to enable them to go to the imperial college.

4,913. He had no recent knowledge of the curriculum at Cambridge but believed that greater attention was paid there to mechanical engineering than to subjects such as surveying, etc., while the practice in the Indian colleges was to go in for a very large amount of descriptive engineering, i.e., mere building construction, and for a very lengthy course in survey. He would prefer that an engineering student should proceed on more scientific lines, that is to say, should deal with the principles of

mechanics applied to engineering and be taught how to determine stresses, and such subjects as applied mechanics, the principles of mechanism, etc. When they had a thorough grounding in the fundamental sciences underlying the practice of engineering they could then acquire descriptive engineering very much more readily and learn how science was applied in practice. The curriculum in the Indian engineering colleges was based purely on the requirements of the Public Works Department and as that Department wanted a certain number of surveyors the colleges paid considerable attention to that subject. The upper subordinates in the Public Works Department were largely employed on building works, working out plans, etc., and the more general knowledge they could get in the college or school the better it was for the Department, and till very recently Indian subordinates and even Indian engineers got very little real engineering work to do.

4,914. As to whether the training given was good enough for an engineer he remarked that surveying was a specialized form of measurement and was not so useful to an engineer as a training in the principles of mechanical engineering, and was of opinion that specialization should be taken at a later stage since directly a man began to specialize his field of action became narrowed. He would use surveying in the same way as one would use a testing machine, i.e., to teach students to make measurement, but did not think it necessary that students should traverse 10 to 30 miles and spend weeks on doing nothing but levelling. They would be much better off if they acquired skill in making general measurements.

4,915. He was of opinion that it was quite impossible to put Indian students on research work and considered that they could be much more profitably employed in other directions. Nor did he think that students would derive much benefit by seeing a professor engaged on research work as it was essential that they should be able really to understand the work.

4,916. (Rai Bahadur Ganga Ram.) He maintained that the conditions in India were such that a young man at 22 should have finished his college course, and that better engineers could be turned out than at present if the students joined at the age of about 17 years. Two years of the total course which would include general education would be spent in a provincial college and three in the imperial college, where general education could also be, if necessary, provided as part of the engineering course.

APPENDIX I.

LIST OF APPENDICES.

- I. Officials and non-officials in Burma, Bihar and Orissa, United Provinces, Delhi and the Punjab who furnished written evidence to the Public Works Department Reorganization Committee in connection with their inquiry but who were not orally examined.
- II. Letter from the Hon'ble Mr. E. G. Stanley, Secretary to the Government of Bihar and Orissa, Public Works Department, to the Secretary, Public Works Department Reorganization Committee, No. 142-T.E., dated the 10th March 1917.
- III. Memorandum prepared by the Government of the United Provinces.
- IV. Memorandum prepared by the Government of the Punjab.
- V. Memorandum prepared by the Chief Commissioner of the Delhi Province.

APPENDIX I.

Officials and non-officials in Burma, Bihar and Orissa, United Provinces, Delhi and the Punjab who furnished written evidence to the Public Works Department Reorganization Committee in connection with their inquiry but who were not orally examined.

Burma.

1. S. Cuthar Valu, Esq., Honorary Assistant Engineer, Public Works Department (retired).
2. G. A. Grossett, Esq., Executive Engineer, Mandalay Division, Mandalay.
3. Mopalin Stone Co., Rangoon.

Bihar and Orissa.

4. M. N. Dutta, Esq., Executive Engineer, Bhagalpur Division, Bhagalpur.
5. R. C. Das, Esq., Sub-Engineer, Bankipur.
6. J. N. Das, Esq., Sub-Engineer, Dumka.
7. The Hon'ble Mr. E. L. L. Hammond, I.C.S., Secretary to Government, Financial Department.
8. The Hon'ble Mr. L. F. Morshead, I.C.S., Commissioner, Tirhut Division.
9. The Hon'ble Mr. H. Le Meunier, C.S.I., C.I.E., I.C.S., Commissioner, Orissa Division.
10. S. C. De, Esq., Sub-Engineer, Purnea.
11. A. H. Vernece, Esq., I.C.S., District Magistrate, Cuttack.

United Provinces.

12. The Hon'ble B. Moti Chand, C.I.L., Benares.
13. Dr. P. P. Phillip, Ph. D. (Gottingen), F.I.C., Professor of Applied Chemistry, Thomason Engineering College, Roorkee.
14. H. P. Jordan, Esq., M.Sc., Professor of Mechanical Engineering, Thomason Engineering College, Roorkee.
15. F. W. Sedgwick, Esq., M.A., M.I.E.E., Professor of Electrical Engineering, Thomason Engineering College, Roorkee.
16. C. J. Veale, Esq., F.R.G.S., Professor of Survey and Drawing, Thomason Engineering College, Roorkee.
17. G. Lacey, Esq., B.Sc., A.I.E.E., Professor of Civil Engineering, Thomason Engineering College, Roorkee.
18. H. Stanley Jevons, Esq., M.A., B.Sc., Professor, Department of Economics, Allahabad University.
19. S. G. Edgar, Esq., B.Sc., Assistant Engineer, Public Works Department.
20. C. H. Hutton, Esq., A.M.I.C.E., Chief Engineer, Public Works Department (retired).
21. M. S. Chodhry, Esq., Zemindar and General Contractor, Bijnor.

Delhi.

22. S. Farman Ali, Esq., B. A., Assistant Engineer, Womens' Medical College and Hospital, Delhi.

Punjab.

23. H. K. Travaskis, Esq., I.C.S., Sub-Divisional Officer, Sonapat.
24. H. Harcourt, Esq., I.C.S., Deputy Commissioner, Rohtak District.
25. Sardar Bahadur Sardar Lahna Singh, C.E., Executive Engineer, Gurgaon Provincial Division.
26. Major W. H. C. Foster, D.P.H., I.M.S., Professor of Hygiene, Lahore Medical College.
27. The Hon'ble Rai Bahadur Ram Saran Das, Proprietor, Messrs. R. R. Mela Ram and Sons, Lahore.

APPENDIX II.

Letter from the Hon'ble Mr. E. G. Stanley, Secretary to the Government of Bihar and Orissa, Public Works Department, to the Secretary, Public Works Department Reorganization Committee, No. 142 T. E., dated the 10th March 1917.

I am directed to invite a reference to Mr. Rose's letter No. 555-E.A., dated the 15th November 1916, requesting the Local Government to furnish the Public Works Department Reorganization Committee with a memorandum of their views in regard to the various matters relating to the execution of civil works in British India

referred to in the draft Resolution forwarded therewith which was subsequently published as Resolution of the Government of India in the Public Works Department No. 06-E.A., dated the 24th November 1916. Briefly the main points into which the Committee have been asked to inquire are whether the methods at present

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employed for the execution of Civil works are economical and suitable or whether more might not be done in the way of encouraging private enterprise or of entrusting the construction and upkeep of certain classes of public works to agencies other than departmental. Incidentally the relations of the Public Works Department with other Departments of Government, the possibility of further decentralization within the Department itself, and the adequacy or otherwise of the rules of the Public Works Department Code, will come under the Committee's investigation. Finally they are asked to consider whether any improvement can be effected in the system of education in Government Colleges, and whether adequate provision is made for the practical training of students after they have received their scientific training in English or Indian Colleges.

(2). On all these points the Lieutenant-Governor in Council would prefer to reserve his final opinion until he has had an opportunity of seeing the report of the Committee and the evidence recorded by them. Meanwhile I am to state briefly the present views of the Local Government in regard to the general questions raised and at the same time to draw attention to certain defects in the existing system, which seem to them to call for inquiry, and to indicate the directions in which they consider that improvement might be effected.

(3). In the first place I am to refer to the Local Government's letter No. 1939A., dated the 15th July 1913 (Annexure A) replying to certain inquiries made by the Government of India regarding the possibility of effecting economies in the scale of expenditure on unremunerative public works, and to say that the Lieutenant-Governor in Council has seen no reason to modify the views expressed therein. Under the system followed in this Province, practically all Civil works, both original and repair, are carried out by the Public Works Department, a few only being entrusted to District Boards, who receive 15 per cent. on the estimated cost of the works. By far the greater part of the work is given out on contract after tenders have been invited, different portions of the work, except in the case of very small projects, being entrusted to different contractors. Most of the local contractors are men of small means, who have had no technical or business training and, as a rule, possess little or no building or engineering qualifications. They supply the labour and sometimes some of the materials, and their work in all its details has to be closely supervised and controlled by the officers of the Public Works Department. Having no capital of their own, and the rules of the Public Works Department Code prohibiting any system of advances from Government, these contractors have to work on borrowed capital for which they are required to pay a high rate of interest. The system, though by no means ideal, works fairly well in practice, and although it is frequently charged against the Public Works Department that their work is expensive and that their rates are higher than those paid by local authorities and private persons, it is generally admitted that a high standard of work is required and obtained. In view of the conditions prevailing in this Province, His Honour in Council is unable to suggest any more satisfactory system for the execution of Civil works. The Public Works Department could not execute all their work on a purely departmental basis without a very large increase in their staff; nor are they in a position bound as they are by rigid rules of accounts, to secure the labour they require at reasonable rates. Some economy might be possible in the use of less permanent materials in some of the less important buildings, and this is a matter which is receiving attention at the hands of Government. Some officers also complain that the rules for the supply of stores do not suit present conditions and recommend that they may be revised so as to obviate the necessity of indenting on the Stores Department of the Government of India for most of the materials used by the Public Works Department, Government being given fuller powers to purchase their requirements locally. It would be an undoubted advantage if entire projects could be made over to large firms of master-

contractors who would take over the works from start to finish and who could be relied upon to carry them out efficiently and expeditiously. Not only would this relieve the Public Works Department of a great deal of their work of supervision, thus enabling them to dispense with some of their subordinate supervising establishment, but there would be the additional advantage that once a tender is accepted, the ultimate cost of the project would be definitely known, whereas under the present system, sanctioned estimates are and must be frequently exceeded. The presence and detailed supervision exercised by a number of subordinate Public Works Department officers inevitably tends to hamper the contractors and make the work more costly. The Lieutenant-Governor in Council would be glad to make over more work to reliable firms of master-contractors, but in this Province there are no such firms, and the few that there are in Calcutta will not take up work in the *muffussal* except in the case of large projects, such as the new Capital Works in Patna and the European and Indian Lunatic Asylums at Ranchi, both of which have been made over to Messrs. ———.

(4). On the whole, therefore, His Honour in Council is of opinion that in this Province private enterprise is encouraged as far as possible and that any advance in this direction is dependent on the further development of the building industry in the *muffussal* and the increase in the number of reliable private firms of contractors, both large and small. He only desires to suggest the advisability of relaxing the rule prohibiting the grant of advances in the case of selected contractors. Very few contractors have sufficient capital to carry through an important work, and they must therefore either borrow money and charge heavily so as to cover the interest, or scamp the work in collusion with subordinates of the Department. It is probable that the charge of dishonesty, so frequently levelled against Public Works contractors and subordinates, is largely traceable to the refusal of advances and of payments on account, the rules regarding which might with advantage be simplified.

(5). As regards the execution of Government work through the agency of local bodies, the system was tried in Bengal some years ago and was abandoned. None of the Municipalities and few District Boards possess a sufficiently competent engineering staff to justify any considerable transfer of Government work to their control, while in the first grade districts, which alone employ fully qualified District Engineers, the work of the District Board is more than sufficient to occupy the whole of the District Engineer's time, and it would be impossible for him to take up Government work in addition to his own duties unless he were given very substantial assistance. In this Province the experiment has been tried in a few cases but with not very encouraging results. For example, Public Works in the Palaman District have been entrusted to the District Board, but the Superintending Engineer reports that the work of the District Board staff requires to be closely supervised and that the work done falls far short of the departmental standard attained elsewhere. It has also been pointed out that the District Engineer in such cases is serving two masters, and that the risk of friction is likely, if anything, to increase. If, as in a few districts of Bengal, non-official Chairmen of District Boards are appointed. On the other hand, the present system undoubtedly involves a good deal of overlapping and duplication of control in areas in which works are being executed both by the Public Works Department and the District Board, and Government are not convinced that the scheme for utilizing the agency of District Boards employing qualified engineering staff to relieve the Public Works Department of the construction and maintenance of some at least of the Government roads and buildings in the districts concerned, must be abandoned. They propose to give the scheme a further trial whenever conditions appear to them to be favourable.

(6). Although, for the reasons given above, the Lieutenant-Governor in Council is not prepared to recommend any radical changes in the system adopted in this

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Province for the execution of Civil works, there are many matters of detail in regard to which there is room for improvement. This is especially so in connection with the question of procedure. The superior officers of the Public Works Department are overburdened with petty routine, accounts and office work which occupy a large portion of their time to the detriment of their more important duties of supervision and local investigation. It has been suggested in some quarters that it might be possible to relieve Public Works Department officers of the greater part of their accounts work and to transfer it to the office of the Accountant-General or of the Collector. It should be possible to simplify the procedure for the preparation and submission of projects, for the framing of estimates, for obtaining administrative approval, etc. A Commissioner of a Division writes "There is an unanimous opinion that the Public Works Department Code is unduly restrictive. This is particularly the case in regard to buildings in charge of Civil Officers. Apparently the Executive Engineer may not take any notice of the most obvious defects or need for repairs in such a building without a form of requisition, nor again may he do the necessary work without sanction from a number of higher authorities. I have recently signed the proceedings of half a dozen Committees called to decide on the site for latrines to be fixed in the compound of various Courts and residences. The average duration of the proceedings in these cases, has been from four to six months, and the signature of four local officers—the Superintending and Chief Engineers, the Head of the Department concerned, and the Commissioner—are all necessary before the work can be done." Another officer writes: "The time left to all the officers of the Department from the Chief Engineer downwards for inspecting works in progress is quite inadequate. These officers are first and foremost Engineers..... They are not Accountants, and it would be a great boon if they could be relieved of the duty of making payments, keeping accounts and filling in all manner of returns.....The amount of petty works which under current rules have to be referred to the Executive Engineer is altogether excessive. The whitewashing of a public building and the petty repairs to a residence, form the subject of detailed estimates which obtain far more scrutiny and examination from the higher officials of the Department than does the work itself." It would be easy to multiply examples but the above are typical instances.

(7). There is a general complaint that the rules of the Code are far too elaborate and rigid and that they do not sufficiently allow for differences in local conditions nor give enough discretion to Local Governments. In the opinion of the Lieutenant-Governor in Council the criticism is justified. He is not aware whether the question of the construction of and assessment of rent on residential buildings falls within the scope of the Committee's inquiry, but here too there are widespread complaints against the rules of the Code dealing with this subject. Under the rules, the admissible outlay on a house is calculated on the average pay of the occupant, but no account is taken of the possible variations in the cost of the site nor of the price of labour and materials due to exceptional circumstances. The rent is calculated, not on the market value, as in the case of private houses, but according to departmental rules. The tenant is compelled to live in the house, his rent is fixed for him, no latitude is allowed, and the rules of the Code secure Government against any possibility of loss, whatever may happen, even where the capital expenditure has been swelled to meet the administrative requirements of Government or to remedy mistakes made in the past when the house was constructed or acquired. Instances could be quoted of undoubted hardship resulting from the operation of the rules, and it has been suggested that a reasonable alternative to the present system would be to recognize that each and every officer requires adequate accommodation according to his rank, leaving it to the Local Government to allot the houses and fix the rental irrespective of the cost of constructing the building. The recent decision of the Government of India

contained in their letter No. 930-A of the 14th February 1917, declining to allow the Local Government to write back to the head "Establishment and Tools and Plant" a sum equivalent to 6·54 per cent. of the cost of the residences which are being built by Messrs. _____ for Government officers in the new Capital, is an illustration of the anomaly which a strict application of the Code rules may occasion. If the work had been done on the ordinary system of petty contracts, the Public Works Department establishment which it would have been necessary to entertain and which has been more than saved by making over the work to Messrs. _____, would not have been charged against the capital cost of the residences. Thus the result of giving the contract to Messrs. _____ is that the tenants will have to pay a much higher rent for the already highly rented houses which they have to occupy in the new Capital, while Government derive the double advantage of an increased rent roll and a saving in expenditure. In the opinion of the Lieutenant-Governor in Council there is a strong case for reconsidering and revising the rules of the Code in this and other matters.

(8). In regard to the remaining points into which the Committee are inquiring, His Honour in Council desires to say very little at this stage. Some decentralization within the Department has been effected already but more is desirable, especially in the direction of giving wider powers to Superintending Engineers. As regards the relations *inter se* of the various sub-divisions of the Roads and Buildings Branch of the Public Works Department, I am to say that they are believed to be generally satisfactory as also are the relations of the Department with other Departments of Government, but into all such matters the personal equation largely enters. The system of education in the Engineering Colleges appears, on the whole, to be sufficient to meet the needs of private agency as well as of Government if it could be combined with a longer and more effective course of practical training. Without going into details, I am to invite a reference to the evidence of Mr. Heaton, the Principal of the Engineering College, Sibpur, and Mr. Wallford, the Principal of the Bihar School of Engineering, with whose views His Honour in Council is in general agreement.

ANNEXURE A.

Letter from the Hon'ble Mr. L. R. Gardiner, Secretary to the Government of Bihar and Orissa, Public Works Department, to the Secretary to the Government of India, Public Works Department, No. 1959-A., dated the 15th July 1913.

I am directed to acknowledge the receipt of your letter No. 908-A. G., dated the 3rd September 1912, on the subject of a possible reduction in the scale of expenditure on unremunerative public works. The Government of India are of opinion that, assuming that proper economy is observed in regard to the scale of accommodation provided for public and administrative offices and buildings, any further reduction of cost must lie either, (1) in the reduction of rates, or (2) in the adoption of a cheaper class of construction for minor buildings. They enquire whether the Local Government consider that economy is possible in these or any other direction.

(2). The Lieutenant-Governor in Council has given the matter his careful consideration after consulting Commissioners of Divisions and selected officers of the Public Works Department. As to the first point raised by the Government of India, namely, the possibility of reducing of rates, the majority of officers consulted are of opinion that, considering the standard of works rightly insisted upon by the Public Works Department the rates are not capable of any general reduction. With this opinion the Lieutenant-Governor in Council agrees. The rates are based on the actual cost of materials and labour with an additional allowance of 12½ per cent. on account of the contractors' charges. As the Government of India are aware there has been a very marked increase of recent years in the cost of labour and materials for all descrip-

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tions of work to which rates for a given specification must respond. It is by no means certain that the rise will not continue owing to economic causes beyond the control of the Department.

(3). As regards the suggestion that the rates paid by the Public Works Department to contractors for materials and work are in excess of those paid by the general public, several of the officers consulted admit that an impression to this effect does exist although they have been unable to adduce any concrete instances in proof of its correctness. The data for complete examination of this question are necessarily scanty as a detailed scrutiny of private builders' accounts is not possible. In fact only two definite cases have been quoted, both of which are in favour of the Public Works Department rates. The District Officer of Monghyr reports that it has been brought to his notice that the ——— Company paid higher rates for a factory building recently erected at ——— than those current in the Public Works Department and the Executive Engineer of Patna furnishes a schedule of rates now being paid by a private builder on certain residences at present under construction in Bankipore, which shows that out of nine rates quoted for the main items of work four are the same as the Public Works Department rates, four are higher and one only is slightly less. Assuming, however, that there is some basis for the impression the comparison is not altogether fair to the Public Works Department as the nature and stringency of the deed of contract will have a considerable bearing on the question. It is generally admitted that the standard of work carried out by the private parties in the *mofussil* is considerably lower than that of the Public Works Department so that no useful comparison of rates can well be made. Private builders frequently work without any specification and are less exacting in their supervision. Moreover, in the majority of cases they are able to make advances to contractors, a practice which is prohibited by the rules of the Public Works Department. The latter point as several officers have noted, is one that must have a considerable effect on the profits of a large number of contractors who take contracts under the Public Works Department as they are compelled to finance their works by loans from local bankers at a heavy rate of interest. It is for consideration whether the rules should not be relaxed so as to admit of advances being made to contractors of known probity under proper safeguards.

(4). As to the second point noted by the Government of India, namely, the adoption of a cheaper class of construction for minor buildings, the Lieutenant-Governor in Council is of opinion that there is here some opening for increased economy. It has been the practice for many years to adopt cheaper methods of construction for minor buildings such as the use of brick in mud mortar and tiled roofs rather than *pucca* brick work and terraced roofs as commonly used for more important works. But the direction in which economy may be looked for is in the adoption of somewhat less stringent specifications and

in the relaxation of certain rigid building rules or customs that have acquired the force of rules in dealing with works of minor importance. The first of these points has already attracted the attention of Executive Officers in their endeavours to keep down rising rates. For example, the use of an inferior class of bricks for plastered buildings and of lower grades of mortar than the standard grade of 1 to 2 for unimportant works are expedients for keeping down cost that have frequently been adopted by Executive Engineers in recent years. The issue of further instructions on this point is at present under the consideration of the Local Government.

(5). The question of the relaxation of building rules for minor buildings is one that has already been taken up by this Government and the orders on the points have recently issued. It has been customary in the past to follow for all buildings without exception loads for calculation of floor joists suitable to the most heavily loaded buildings. Extravagant expenditure in foundations has frequently occurred owing to the inclusion of excessive assumed live loads in calculation and to the limiting of foundation pressures to a figure suitable to the alluvial soil of Calcutta without reference to actual prevailing conditions, will doubtless lead to economy.

(6). With regard to the enquiry made in paragraph 4 of your letter on the subject of a definite comparison between *kutcha* and *pucca* buildings including maintenance charges available records do not furnish any very conclusive figures on these heads as no Capital and Revenue Accounts are kept for the majority of *pucca* buildings which are non-residential. There is no doubt that economy does result from the use of a cheaper form of construction for minor buildings, but in the case of this province such a system is not a reversion to an older policy but one which has been regularly followed. In view of the heavy annual recurring cost required for repairs to *kutcha* buildings the Lieutenant-Governor in Council doubts whether so far as the types of construction go there is any scope for further economy.

(7). As regards the suggestion of the Government of India that it might be possible to reduce the superior establishment by extending charges of supervision, all the officers agree in deprecating any reduction in the superior supervising agency which they consider could only be effected at the cost of efficiency. With this opinion the Lieutenant-Governor in Council agrees. So far as this province is concerned it would be most unwise to extend existing charges most of which are already recognized as being if anything too large for effective supervision. In view, moreover, of the fact that the commonest accusation made against the Public Works Department is that the contractors are forced to keep their rates high in order to satisfy the illegitimate demands of the subordinate establishment, His Honour in Council is unable to support a measure which must necessarily weaken the supervision exercised over the lower grades of the service.

APPENDIX III.

Memorandum prepared by the Government of the United Provinces.

It must be admitted that Public Works Department efficiency has been on the wane of late years due to the pressure of multifarious duties having grown too great for the superior staff. Moreover, this staff is now deplorably mixed. Our Imperial Engineers, though unequal, are good on the whole, except for certain Indian recruits in recent years. They are lacking however in *esprit de corps*, and many of them carry on their work with a detached air as if they were not part of the machinery of Government and were under no obligation to protect Government against its own mistakes. The Imperial and Provincial cleavage has not proved successful in the Public Works Department or at least it is now out of date. But whatever changes be made in this direction we shall still have to be satisfied with an insuffi-

cient cadre of inadequately equipped men, while the work is steadily increasing. There is a wide-spread impression that malpractices are rife in the subordinate ranks, and that the old Public Works Department standard of efficiency is no longer attainable, unless we can return to the former practice of entire supervision by gazetted officers. The cost of this would now be too great with the growing demands for new works and the political aspirations of the country. Moreover, the recruitment of a sufficient number of young engineers would result in embarrassing blocks hereafter. We should therefore drop aiming at the impossible and be contented with the next best thing.

(2). The work done by the Department is good and durable. Recent inquiries into the comparative cost

APPENDIX III—continued.

of specific buildings erected by private agency and the Public Works Department prove that, after allowing for the departmental charges, the cost of this class of work is not unduly expensive. But the methods followed are somewhat inelastic and the procedure requires more adaptability. A greater variety of standards is wanted to suit different conditions and finances, even at the risk of some additional cost in the long run.

(3). From both the industrial and political aspects, there is a real need for larger openings to contracting firms of all kinds. The more we decentralize work and the less direct we make our executive control of public works, the more opportunities will India offer to private civil and specialized engineers. At present the best products of Rurki College cannot compete with those of European establishments, nor is there at present any scope for employing passed students outside the Public Works Department, save in large centres. The profession of civil engineering needs exalting in the public mind and being made attractive to the best indigenous talent. A good deal should be possible in this direction by making Rurki the means of obtaining a valued University degree. In fact, the time has come for Rurki to extend its functions.

(4). We should aim at divesting the Public Works Department of all duties which can be assumed fairly efficiently by other agencies. For instance, we should entrust all unimportant work to local agencies. When this was last tried in these provinces, in the early eighties, it degenerated into a dual control of works in every district and that very naturally proved to be both inefficient and costly. The change was probably made too suddenly and on too large a scale. We should profit by the mistakes then made and now act more cautiously, confining the experiment to a few selected districts in the first instance. In fact, the present dearth of qualified engineers and the non-existence of reliable firms gives us no option at the outset. For the execution of large works, established building firms should be encouraged to become reliable, and the necessary initiative for the creation of new contracting firms should also, in due course, respond to adequate measures taken to attain that end. Among other forms of encouragement which suggest themselves, one of the most suitable might be to maintain Government lists of qualified contractors classed according to their competency, as judged by their capacity to execute works more or less without direct supervision. The actual Government charges for supervision and inspection might vary inversely with the competence and reliability of any firm. The magnitude of the works already executed by any firm would be one criterion of competence. A tentative scale of percentage charges for Government supervision could be adopted to suit the classification of the firms, and the saving in cost of supervision, in each case, could be handed over to the firm on the completion of the work as a bonus for relieving Government of the duty. Existing firms would be classed on their past record, subject to revision periodically. Promotion from class to class could also be permitted on the production of proof of the employment of a qualified private staff. But whatever concession be made to qualified firms, it would be necessary for the Public Works Department to retain full discrimination to decide the actual extent of supervision and inspection necessary in each case.

(5). Tendering for the execution of large works, or groups of minor works, in each centre, should continue to be open to all listed contractors as now, whether classed as qualified under the proposed system or not. But other things being equal, qualified contractors would be given prior claim to the contracts. In this way the unqualified men who now contract only for the supply of work erected under Government supervision will find their proper place as sub-contractors of qualified firms. Eventually the Government subordinate staff could be curtailed, apart from any delegation of duties to local bodies.

(6). The question of designs for Government structures should always be kept quite separate from the subsequent matters of execution and supervision. As a rule, separate

firms should be entrusted with the design and execution of a work. The dual office of designer and builder is anomalous as the interests at stake are antagonistic. Suitable fees based on the home practice would be paid for rough and final designs and working details. The payment of the full fees should depend on the acceptance in whole or in part of the designs. We cannot hope to get competent private agencies for designs for many years to come, and the bulk of the work must therefore continue to devolve on the Public Works Department. In order to carry out this duty effectually and without delay it has long been recognized that a central designing section acting in close conjunction with the Consulting Architect is essential. All essential details would be drawn out in this technical or designing section as well as specifications, and the contracting firms would only be expected to supply themselves with the less important working details such as are now left to the supervisory establishment.

(7). Owing to the unusual shortage of staff since the outbreak of war the Local Government decided to entrust the design and erection of certain school buildings to a private firm of consulting engineers (Messrs. ———) already established in India, on the firm's own terms. The contracts are for supply of buildings under the control of the Director of Public Instruction who is empowered to call on Public Works Department officers should he consider this necessary. The agreements did not provide for either inspection or supervision by the Public Works Department, and hence it is impossible to arrive at any early decision as to the results. But the few buildings so far completed have recently been inspected by Superintending Engineers in as thorough a manner as possible at this late stage, with the result that the work appears generally to be sound and, so far as can now be ascertained, Government has got fair value for its money. The constructional methods followed were not altogether up to Public Works Department standard and the roofs are likely to give trouble. It looks as though the supervision were not as thorough as in the case of Public Works Department works.

(8). The following is a summary of the views of this Government under the particular points of information mentioned in paragraph 2 of Government of India resolution no. 06-E.A., dated the 24th November, 1910 :—

(i). (1). The methods of the Buildings and Roads Branch of the Public Works Department are economical so long as the superior staff is maintained at an adequate strength. The cost of work is likely to increase with any relaxation of departmental methods or delegation of powers to local bodies.

(2). The operations of this branch of the Public Works Department cover a wide range of duties under a single control, and it is difficult to conceive how they could be discharged in a cheaper manner under any system of divided control. But as the Public Works Department in the United Provinces has long been short-handed, the methods are no longer either economical or suitable.

(3). It has been held in certain quarters that the methods followed in the preparation of projects are unbusiness-like, in that they result in serious delays. This defect is however inevitable so long as other departments rely so much on the engineers to discover their real needs at the initial stage. In fact, the necessary safeguards against waste of energy in designing are, to a large extent, responsible for this complaint. The remedies for this are two-fold, viz., the insistence on the drawing up of schedules of demands whenever new buildings are wanted and the centralising of all designs of importance.

(4). One defect of the departmental system now in force is the tendency to specialize and sub-divide with the laudable object of increased efficiency. While a few expert advisers are needed they should continue to be recruited on a temporary basis so far as the needs of the Department are concerned. Any recruitment of specialists to the permanent cadre of the Department would lead to difficulties besides being a retrograde step in the development of the country.

APPENDIX III—continued.

(ii). (1). Private enterprise generally is not sufficiently encouraged at present and the Public Works Department is overburdened with work.

In some directions, such as in electrical and mechanical installations and the distribution system of water-works, private enterprise has usually been relied on in spite of the fact that departmental work would have been cheaper, as lately proved in the case of the electrical fittings in Government buildings. Steel bridges, roofs and office fittings are frequently entrusted to well-known qualified firms, but local building firms have usually proved to be both unreliable and expensive.

(2). Some relief can be obtained by handing over the maintenance of buildings of other departments to the departments concerned, subject to the advice of the Public Works Department. The Inspector General of Police and the Director of Land Records and Agriculture are already in charge of all minor buildings of their departments. The Inspector General of Prisons goes further and maintains all prison buildings, the Public Works Department assisting only with the more technical work. On the same lines the Collector might perhaps assume charge of the revenue buildings (*katcheries*, *tahsils*, etc.) and where possible other Heads of Departments may similarly be entrusted with such work. But the charge of Government and circuit houses, Secretariat buildings, as well as all residential buildings borne on the Capital and Revenue Accounts, would be retained by the Public Works Department.

(3). Next, except in the hill districts which offer little scope for private enterprise, it is desirable, in the interests of the industrial development of the country, to entrust the execution of all ordinary imperial and provincial works of a minor character and the upkeep of all provincial and local roads to local bodies, subject to adequate safeguards. A suitable limit of cost up to which local bodies might be permitted to undertake original imperial and provincial works would be Rs. 10,000 both for buildings and roads. Safeguards would take the form of retaining the preparation of the projects and inspections of the works in the hands of the Public Works Department.

(4). Similar but modified safeguards would be necessary in the case of local works costing over Rs. 3,000 each, the control of which would be vested in local bodies. Such projects should be approved generally by the Executive Engineer and the execution of the work would be subject to that officer's inspection.

(5). The execution of all major works, i.e., works costing over Rs. 10,000, should continue to be controlled by the Public Works Department, which would entrust them only to qualified firms where such are forthcoming in response to adequate financial encouragement. The supervision of local major works would devolve on the local engineer so far as the responsible Public Works Department officer considers this to be necessary.

Major local projects should be approved at the usual two stages if not actually prepared by the Public Works Department.

(iii). (1). The changes suggested under (ii) postulate the reorganization of the Public Works Department staff much on the lines adopted in these provinces in 1892. Most of the existing district staff of the Public Works Department would go over to the district boards. The rest would be retained as Assistant Engineers or subordinates of the Public Works Department. Executive Engineers as divisional engineers would be in charge of imperial and provincial projects of all kinds. They would inspect all imperial and provincial works entrusted to the charge of local bodies, such as municipal and district boards; as well as assist with projects for, and the inspection of, local works as proposed under (ii).

(2). Besides imperial and provincial major works and residence, the Executive Engineer will retain charge of all river training works and public improvements as well as works of the Archaeological Department. His services would continue to be available for contribution works.

(3). Each Executive Engineer will require at least one Assistant Engineer as a personal assistant. In this way it should soon be found possible to reduce the number

of executive charges from 16 to 10 which would make them once more coterminous with the civil divisions. A return to the former three circles of superintendence should also be possible, thus liberating the fourth Superintending Engineer for duty as Deputy Chief Engineer at headquarters. The duties of this officer would be to relieve the Chief Engineer of his less important duties and to control the proposed central designing section of the Chief Engineer's office. Such a post is a real necessity in these provinces whatever line is followed in the reorganization. An Assistant Engineer would be attached to this technical section and the post would be filled in rotation by experienced Assistant Engineers.

(4). The Sanitary Engineer's staff has never been organized on a permanent basis. The work done is for local bodies and must always fluctuate with their needs: it consists entirely of municipal projects which are sometime carried out by the sanitary staff, but is more often entrusted to the ordinary Public Works Department staff or to the municipal boards.

The engineering staff of the Sanitary Branch is on a temporary basis, except for the Sanitary Engineer himself who is an officer of the imperial engineer establishment holding the rank of Superintending Engineer, and an Executive Engineer who is also of the imperial establishment. The latter officer is liable to be brought back to the ordinary Buildings and Roads work at any time should the need arise. There are two Assistant Engineers each on a five years' covenant who were selected by the Secretary of State for India. Both of these officers had considerable experience of sanitary works in England before they came to India in 1914. The remainder of the engineering staff of the Sanitary Engineer is taken on from year to year.

(5). From time to time suggestions have been made that officers of the permanent establishment should specialize in the Sanitary Engineer's Branch, but it is questionable if this would work as well as getting men from home with experience of sanitary work who, after obtaining a knowledge of the conditions in India, would eventually be fitted to hold the appointment of Sanitary Engineer to Government. At present there is difficulty in staffing municipal engineers' posts in a satisfactory manner, and it seems necessary to devise a cadre to include both municipal engineers and the Sanitary Engineer's staff on a *quasi*-permanent basis.

(6). Similarly, engineers specially recruited for district boards would be borne on such a list and controlled by the Local Government.

(7). The architectural side of the Department should remain to a large extent advisory and become more educational. Projects for large buildings will continue to be prepared by the Consulting Architect working in co-operation with the proposed central designing section.

(8). The staffing of famine works would naturally be entrusted to local boards, subject to general control of the Collector who would have the services of the Executive Engineer as adviser.

(iv). Generally, the Public Works Department meets the needs of other departments, though often in a dilatory and unbusiness-like manner. The Chief Engineer urgently needs the assistance of the Deputy at headquarters to relieve him of his less important duties and to supervise the proposed central designing section of the office. This improvement will go far to remove the charge of unbusiness-like methods now levelled at the Department.

Further, local rules are needed to govern the operations of the various sub-divisions of the Buildings and Roads Branch where they overlap. This matter is already being attended to and the relations generally between these sub-divisions are satisfactory.

(v). (1). Decentralization within the Department depends on the qualifications of the staff and experience shows that no increased efficiency is to be obtained by any further advance in this direction. On the other hand, there is a real need for more centralising in the matter of designs. Our standard plans are sadly out of date and we have no adequate machinery for dealing effectually with this at present. Important bridge

APPENDIX III—concluded.

work needs some specialization—especially the reinforced concrete type which is now being largely adopted. There is also a need of collaborating with the Consulting Architect at headquarters over large building schemes to a greater extent than the Chief Engineer can be expected to do.

Incidentally the existence of such a technical branch would also result in accelerating business while the Chief Engineer is on tour or, in his capacity as Secretary, is engaged at council meetings or on committees.

(2). The delegation of powers needs some extending. Executive Engineers' powers of sanctioning estimates and acceptance of tenders should be permitted on a sliding scale depending on length of service, up to a maximum of Rs. 10,000. The 5 per cent. limitation on Executive Engineers' powers of passing excesses over estimates should be increased to 10 per cent. in the case of senior officers. This would reduce the need of so many revised estimates without any material risk.

(vi). (1). Any drastic changes of organization must be followed by material alterations in the Public Works Department Code rules, and these changes could only be made after careful consideration by a representative committee.

(2). There is one point which has always affected the convenient accounting for Public Works Department works. It is the fact that the end of the financial year does not correspond with the end of the working season. This makes it impossible to work closely to allotments and results in vague budgeting and some real abuses. Rightly or wrongly inexperienced officers think that they are expected to utilize allotments in full. They often imagine that failure to work up to their allotments is considered discreditable. Hence, while over-payments take place in some cases, lapses are reported in others at a very late date. This seriously upsets the budget for the new year. It would suit far better if all savings on incomplete works at the end of the year could be carried over and added to the budget grant when liberated in the following year: but to this there are probably insuperable financial objections.

(3). Similarly, the progress of large works executed by contract extending over a series of years, should, so far as the requirements of the Financial Department permit, be freed from budget limitations. Any such limitations naturally hamper operations and thus tend to increase the cost of building.

(4). The maintenance estimates for buildings, as now prepared, involve some unnecessary work owing to the fact that they are prepared long before the actual requirements can be stated. Special rules seem to be necessary to meet this defect. Repairs might be permitted within budget limits, subject to estimates being sanctioned by the 30th November of each year.

(5). *Stores*.—There should be an efficient purchasing agency for valuable imported materials of all kinds at

the chief ports and none should be allowed to go outside this without approval of the Chief Engineer. The present testing establishment at Calcutta could be expanded to suit. Officers responsible for the execution of works should be empowered to use this agency, subject to safeguarding limits.

(vii). *Rurki College*.—(1). This no longer attracts the best material available. The recruits now turned out are professionally inferior to British engineers and greatly lacking in energy and initiative. The teaching is inadequate and not sufficiently practical. The college needs reorganization as a training college solely for civil engineers with a sound knowledge of architecture, sanitary engineering and electricity. Post-graduate courses should be instituted in railway, sanitary and electrical engineering.

(2). It may be found possible to include advanced courses in mechanical engineering at this college, but this must be optional. Mechanical engineers, as such, should be taught elsewhere at an industrial or polytechnical school near a commercial centre.

Rurki College must be purged of its adjuncts such as subordinate and technical classes. It should be given a definite status in the University, so that its students may have the chance of obtaining a degree in engineering, and thus made more attractive to those who have had a full general education.

(3). Polytechnical schools framed to cater for the industrial development of the provinces will have to be created near industrial centres *inter alia* for the supply of subordinates of all kinds. Here severely practical instruction should be alternated with workshop training. The education and training should cover a wide range of technical and mechanical work including the building trades and the practical sides of railway and road construction, hydraulics and electricity. A certain number of selected students might be given opportunities for taking an advanced course of mechanical engineering at Rurki as a means of obtaining a special diploma.

(viii). *Practical course*.—As an engineer student is not immediately of value until after undergoing a course of training on works for a period of at least two years, some facilities must be provided for such training at the expense of the students both from English and Indian colleges. Usually this can be managed on Government works, but arrangements might also be made for this with private firms as the opportunity offers. Such a course will have to be supervised by a special officer as a superintendent of apprentice engineers. The one or more students holding guaranteed posts would undergo the same course, but would be in receipt of a salary instead of having to pay fees. The broader question of any remission of the fees generally to encourage the public to adopt civil engineering as a profession is beyond the scope of this memorandum.

APPENDIX IV.

Memorandum prepared by the Government of the Punjab.

I.—Whether the methods at present adopted for the execution of Civil Works are economical and suitable for the purposes for which they were devised.

It is assumed that the Committee is acquainted with the methods at present in vogue and it is unnecessary to describe them in detail.

Briefly speaking, however, the operations of the Public Works Department are divided into two main heads—

- (1). Original Works.
- (2). Maintenance and repairs.

The methods and adopted for carrying out these are—

- (a). By contract.
- (b). By Departmental agency.

The contract method is used for the great majority of works and repairs—in fact, whenever it is possible to do so. Departmental agency is only resorted to when the work done is not easily susceptible of measure-

ment such as—for instance, petty repairs of metalled roads and petty odd job repairs to buildings. In practically all cases the entire projects for an original work or estimates for repairs are prepared by the Department (in consultation, in the case of works done for other departments, with the Head of the Department concerned). Normally, as already stated, the execution of the work is entrusted to local contractors. As a rule the contractor possesses only slight technical knowledge so that the laying out of the work and its entire supervision, account-keeping, measurements, etc., devolve on the Public Works Department.

The above is the normal procedure to which however there are occasional exceptions as will be described in paragraph II below.

It is now to be considered whether this procedure is—

- (a) suitable,
- (b) economical.

APPENDIX IV—continued.

(a). As regards the execution of works it will be seen from the above that the Buildings and Roads Branch of the Public Works Department is in effect a body of consulting and inspecting engineers permanently retained by Government.

The suitability of this system is obvious in the cases (which are unavoidably frequent)—

(1) of constant changes in the design of a project necessitating sometimes its complete recasting,

(2) delays due not only to the above cause but to financial reasons which may result in postponement or even in abandonment of the work concerned.

The staff employed on the preparation of such projects, being in permanent employment has its hands full, not only with projects but with maintenance and routine work, and such delays and postponements involve no extra expenditure as would be the case were private agencies employed. Something has been done to simplify the preparation of projects by the adoption of standard plans for various types of Government buildings, but the Lieutenant-Governor thinks that more could be done in this direction thereby securing more speed and economy. He also thinks that as regards types of buildings and materials used insufficient consideration is given to local variations of climate, etc., but these are matters for arrangement locally.

The above statements, however, deal with one aspect of the Branch, viz., its duties as regards execution of works.

In addition to this its duties are many and varied.

It is entrusted with the maintenance of the main Communications and Provincial buildings of the Province.

It advises Local Bodies on professional matters and scrutinises (and where advisable undertakes) the preparation and execution of their projects.

As advisers to Government departments it forms a valuable aid in the development of the Province.

It keeps continuous records of local resources, rates, statistics, etc., etc., collects Government rents, and takes action under the various Acts of Government.

Its Secretariat advises the Local Government on matters appertaining to Railway development.

These many duties all fit in with one another and ensure the full employment of the personnel in the most efficient way possible.

The officers of the Department are transferred from station to station in the course of their service so that as they rise to higher positions involving administrative capabilities they attain an intimate knowledge of the resources and conditions of the various parts of the Province.

It is held therefore that under the existing conditions the present methods are suitable.

(b). As regards economy. In considering this aspect of the case we may view the figures giving the actual cost to Government of its establishment and compare them as far as possible with the figures that would be obtained were the alternative introduced, viz., the entrusting of works to agencies other than departmental.

Taking the figures obtained from the Annual Administration Report of actual outlay for the past five years we find that in this Province so far as Provincial Works and Repairs are concerned the following percentage was reached in the cost of establishment employed by the Public Works Department :—

Year.	Cost of works and repairs.	Establi- ment charges.	Percentage.
	Rs.	Rs.	
1911-12	44,18,600	7,76,383	17.67
1912-13	50,25,421	7,81,303	15.54
1913-14	65,32,723	8,67,207	13.27
1914-15	59,86,471	8,92,576	15.03
1915-16	41,49,010	9,21,685	22.21
AVERAGE	52,22,447	8,40,228	16.26

At first sight these figures would appear to lend weight to the idea that private agencies could undertake works at a lower percentage and that it would pay Government from the financial point of view to employ them.

The operations of this Branch, however, are not confined to Provincial works alone. Taking into account the total actual work done during the same period, the results are as follows :—

Year.	Total expenditure under all Fund Heads on Works and Repairs.	Total cost of Establish- ment.	Per- centage.
	Rs.	Rs.	
1911-12	58,60,753	9,07,460	15.48
1912-13	70,10,001	9,72,835	13.85
1913-14	81,35,419	10,30,871	12.67
1914-15	71,41,640	9,88,035	13.83
1915-16	57,57,616	9,88,072	17.18
AVERAGE	67,83,007	9,77,634	14.41

In addition to the above, detailed projects have been prepared during the past five years—

(i) for Provincial works amounting to Rs. 6,28,837 some of which have been abandoned and others deferred indefinitely ;

(ii) for Local Bodies amounting to Rs. 1,26,98,000 for which no charge was made. Only a portion of the latter have been carried out (it is difficult to calculate the exact amount).

With private engineering firms the customary practice is generally speaking to divide their total charges (usually 10 per cent.) into two equal parts, viz., one-half for the preparation of the project and working drawings, and the other for supervision of the execution of the work. To make the above table of figures comparable with the charges of a private firm it would be equivalent to adding half the value of the projects prepared on to the column of total expenditure.* If this were done the above average percentage becomes further reduced to 12.04.

Alternative projects have in many cases been prepared, but these have not been taken into account nor has any allowance been made for the advice given gratuitously to Local Bodies, etc., which has its monetary value and for which a private firm would ordinarily exact charges.

It would appear therefore that as far as economy is concerned the present system would compare not unfavourably with that of employing private agency. It must be remembered further that the introduction of such a system will even when fully established cause a reduction only, and not a complete abolition of Public Works Department establishment charges. At the same time the Lieutenant-Governor thinks that the present system has this defect that the cadre being a fixed one cannot be contracted in years when financial stringency compels a reduction in the Public Works budget, though it can be expanded by the employment of Temporary Engineers to meet an unusual press of work. Were it not for the deputation of so many Public Works Officers to Military duty the superior staff would have been excessive last year and this when the allotments have had to be cut down to a minimum. This, he considers, is an argument in favour of the change.

11.—Whether under the existing system private enterprise is sufficiently encouraged and whether it is possible and desirable to entrust the construction and upkeep of certain classes of Public Works to agencies other than departmental, and if so, upon what lines such change should be effected.

In the foregoing pages an endeavour has been made to show that the present system is in ordinary conditions

APPENDIX IV—continued.

fairly economical and generally suitable. They have dealt solely with normal conditions under which work has been carried out, i.e., entirely by departmental agency with the employment of local contractors. Private agencies, however, have been employed whenever it has been advisable to do so, i.e., large works involving expert knowledge which is beyond the scope of the Public Works Engineer, as for instance the details of the machinery of the Simla Hydro-Electric Scheme, Sanitary Projects including the supply of hot and cold water, Water Closets, etc. In such cases the drawing up of the details of the projects and the supply and erection of the machinery, etc., has been entrusted to private firms who specialise in these particular branches. These instances however are not common.

We have now to consider whether it is possible and desirable to encourage this procedure to a further extent.

This procedure is encouraged to its fullest extent in England and the reason is not far to seek. The lines on which works are undertaken in England are far more liberal and costly than they are here or will be for very many years to come, and there is an enormous scope not only for large engineering firms but for experts in all the minor branches of Engineering.

As an instance the construction of a large building may be taken. In such a case, at home, the design would in all probability be obtained through public or limited competition. In such cases a consulting architect called the "Assessor" collects and lays down the requirements and cost, etc., of the proposed building in a schedule called the "Conditions of Competition," judges the designs sent in by the competing architects and advises as to which design should be accepted.

The successful architect prepares the design, specification, etc., in detail, and is responsible for the successful execution and completion of the work. The building work is entrusted to a firm of building contractors. Highly specialised work such as ornamental ceilings, metal work, sanitary fittings, electrical work, stained glass, etc., is not executed by the contractor, but by sub-contractors selected (by competitive tendering) by the architect as the work proceeds. They are paid by the contractor who has included sums (previously specified by the architect) in his tender for these items of work. The system throughout of close competition keeps the prices to an efficient working minimum.

In this province large firms of Consulting Engineers and Contractors are practically non-existent and cases of their being employed by Government under existing conditions would be so few and far between that they could not hope for financial success. Were such firms to exist however and were means given for their encouragement it must be admitted that the class of workmanship they would turn out would probably be superior to that done by the direct agency of the Department the *personnel* of which are of necessity jacks of all trades. Not only would their knowledge of detail be superior but the amount of direct supervision given by the Engineer-in-charge would be greater and more efficient than that of an ordinary Executive Engineer who has to do a large number of inspections daily.

Assuming therefore that the further encouragement of private enterprise would tend to greater efficiency, if not to economy, and also that it would encourage industrial activity and tend to react on the educational system of the country in an advantageous way, we have now to consider the lines upon which effect should gradually be given to such changes.

In the Government Resolution which is now being considered it is suggested that much work of a simple and unimportant character which is now undertaken and supervised by highly salaried officers of Government could be carried out at a reduced cost under contract subject to Government inspection. It is further urged that local bodies should be encouraged and enabled to arrange more extensively for the execution of their own works by their own staff or private agency.

While the Local Government is inclined to agree with the latter suggestion it is of the opinion that as regards the former, encouragement should be given to private agency for the construction of large and important works rather than works of a simple and unimportant character.

The ultimate result of this policy would be (1) the increase in the responsibility and numbers of the staffs of the Local Bodies, (2) the reduction of the staff of the Public Works Department and their change from constructing Engineers into Inspectors of Works.

As regards the Local Bodies the effect would be a healthy one and in keeping with the policy of local self-government which the Local Government has always had in view. It is felt, however, that such increase in responsibility would necessitate the adoption of a more efficient system of recruitment of the Local Body staffs. This point will be dealt with later.

As regards the Public Works Department, Buildings and Roads Branch, the effect would be the gradual reduction of establishment with the introduction of private agencies.

Speaking broadly the Public Works Department should gradually hand over all its maintenance, repairs and minor works to local bodies who would receive the necessary funds and would increase their staff as required. The routine work which is inseparable from them, such as the returns, road and arboricultural tables, collection of rents, etc., would gradually go over to the local bodies, the Buildings and Roads Branch gradually reducing its minor and routine work and confining itself to the larger and more important original works which would be carried out by private agency under their supervision. This again would necessitate considerable reorganization of their staff. The method suggested for this is given later.

For the initial stages the procedure suggested is that Government would engage engineers in private practice and authorize them for a percentage to prepare projects and arrange for the execution of works commensurate with the qualifications of the Engineer concerned. This would result in the gradual building up of a class of private practitioners to whom works of increasing importance could be entrusted as their reliability became more assured.

The private practitioner would employ contractors with the approval of Government on the same lines as such contractors are now employed by Government. He would submit measurements and bills to the Executive Engineer who would then become a Government Inspector for check and payment and his work would be under the direct supervision of this officer. As the reliability of such a private practitioner became more assured a further step might be tried of omitting the check of measurements, etc., and relying merely on a general survey of the work concerned. In this way a reliable and capable class, both of individuals and private firms would come into existence and with them would come the gradual reduction of the departmental staff. It must be realized that with the gradual introduction of reliable firms and the further development of the province there will be a considerable tendency for such firms to specialize in the various branches of engineering. Such a tendency will of necessity lead to greater efficiency and as such it is to be encouraged—but to enable the Department to keep pace with this tendency it is necessary to enlarge their horizon gradually and to recruit and train a staff of engineers who will be capable of inspecting with efficiency the works entrusted to specialists of various kinds.

III.—Whether any changes recommended by the Committee necessitate any modification of the organization of the staff of the Public Works Department, and if so, what.

As pointed out above the changes suggested would result in a modification of the organization of the staff

APPENDIX IV—continued.

not only of the Public Works Department but of Local Bodies.

As regards the staffs of Local Bodies it is felt that even under the present conditions the system for recruiting the engineering staff is unsatisfactory. Under existing rules it is obligatory for District Boards, when making appointments connected with works the proper discharge of which requires some professional skill, to obtain the previous sanction of the Sanitary Engineer to Government in the case of sanitary works, and of the Superintending Engineer, Public Works Department, of the Circle concerned in the case of other works. Any member of the establishment so entertained is liable to discharge if the Sanitary Engineer or the Executive Engineer of the Division is of opinion that he is incompetent. Similarly municipalities of the first class are required to obtain the previous approval of the Chief Engineer, Public Works Department, to the appointment of a Municipal Engineer, and in the case of other municipalities of the Superintending Engineer, Public Works Department. As regards sanitary works, the previous approval of the Sanitary Engineer to Government is necessary. No engineer of a municipality of the first class can be dismissed without the approval of the Local Government and of other municipalities without the approval of the Commissioner of the Division. Each particular Municipality or District Board is entirely self-centred as far as its recruitments are concerned. There is no system of inter-transfer or satisfactory system of promotion.

If their selection of an engineer happens to be a good one the individual concerned realizes his value after a short time and eventually demands a salary which the Body concerned is not justified in paying with the result that he betters himself elsewhere and the Local Body is left to make another selection from the open market.

Should their selection be a bad one it probably takes them considerable time to realize the fact and even then they are probably actuated by feelings of pity in deciding whether to dispense with his services and so throw him out of work.

Thirdly, the engineer himself may be unfortunate in not establishing cordial relations with certain members of the Committee in which case he has either to put up with constant friction or resign.

The condition of the ordinary Municipal or District Engineers would, it is considered, be greatly ameliorated if it could be arranged that they should be all brought on to one cadre.

Transfers could then be arranged in the interests of Local Bodies generally and a proper scale of promotion be fixed enabling engineers to rise in position from small outlying stations to larger and more central ones involving greater responsibility and higher pay.

The gradual introduction of the changes suggested would emphasize the necessity of bringing the Local Body Engineers on to a proper footing and as the increase in their staff would be accompanied by a reduction in the staff of the Public Works Department their ranks could be augmented as required from this source. They would remain for the purposes of general routine and execution of works under the direct control of the Local Body, but for promotion and transfers the Local Bodies would act on the advice of the Public Works Department or of whatever agency takes its place. In this respect their position would be analogous to that of a Divisional Accountant who, although under the direct orders of the Executive Engineer, is for purposes of pay, transfer, etc., under the Accountant-General.

The effect of the changes proposed in the Public Works Department will be the gradual reduction of their numbers. The only effective way to regulate this is to gradually close down the recruitment of permanent engineers and employ only temporary ones as required. This arrangement is by no means satisfactory, but it is inevitable while the system of procedure of the Department is in a state of transition. It will however afford

a scope for Indian engineers who would be employed on the temporary establishment and would be judged by their own merits. (During the last two years about 15 Indians trained in Engineering in the University of London, Durham, and Glasgow and the King's College and Crystal Palace have sought employment in the Public Works Department, Buildings and Roads Branch, but owing to the reduction of establishment on account of curtailment of expenditure during the war none of them could be given employment.)

When the ultimate end is attained, and a large class of reliable firms of consulting engineers and contractors exists, the Department will have dwindled down to a small number of Inspectors of Works governed by the Head of the Department who will be Chief Inspector or Director of Works and Secretary to Government. The Inspectors would correspond to the present Superintending Engineers who would have Assistant Inspectors under them. The result of the proposed system would be the gradual elimination of junior appointments, and in the various branches where specialising is necessary, it would probably be convenient to recruit occasionally from well known firms.

In other cases appointments on the permanent establishment should be preceded by a thorough training at Home on the particular branch of work on which the engineer concerned is required to specialise.

IV.—Whether the Public Works Department meets the needs of other Departments of the Administration and whether the relations inter se of the various Sub-Divisions of the Buildings and Roads Branch, Sanitary, Architectural, Electrical and Civil Engineering are satisfactory.

(a). The relations between the Public Works Department and other Departments of the Administration will first be dealt with. These are considered to be eminently satisfactory. The smooth and efficient working of the Department in executing the demands of other departments depends to a very great extent on the existence of friendly relations between the officers concerned, and the Public Works Department has always seen that the members of its staff make a point of becoming personally acquainted with the officers of other departments. Such relations resulting where possible in the substitution of personal interviews for lengthy correspondence, and tend greatly to the smooth working and efficiency of the undertakings of the Department.

The only item in inter-departmental relations which requires especial mention is perhaps that of for Government officials' residences. The construction and maintenance of these is perhaps the most thankless task allotted to the Department. Not only is it impossible to design a residence to suit all possible tenants, but Government officials are inclined to be far more exacting as regards interior details and more especially annual repairs than they would be with an ordinary landlord.

(b). The relations inter se of the sub-divisions of the Buildings and Roads Branch.

In dealing with this it would perhaps be as well to state briefly the duties of the various branches—

Sanitary.—In this Province there is a Sanitary Engineer who is of Superintending Engineer rank; he has a Personal Assistant, a staff of surveyor and draughtsmen and an office. His duties are to advise Government and Local Bodies in all matters relating to drainage and water-supply; he draws up schemes for Government and also for Local Bodies; he reports to Government on the condition of schemes which are in operation. Where necessary he also arranges for the execution of the sanitary works, but more commonly their execution is entrusted to the Executive Engineers, or to Local Bodies. He is a member of the Sanitary Board and controls the working of the Boiler Inspector's Department under the Boiler Act. The post of Sanitary Engineer was created in 1900; his relations to the other branches and departments are considered to be satisfactory.

APPENDIX IV—concluded.

Architectural.—A Consulting Architect to the Punjab Government was appointed on 19th January 1914, on a five-year covenant. His duties are to advise Government on all matters connected with architecture and town-planning, and to prepare designs for civil works. He is assisted by a staff of draughtsmen and a Correspondence Clerk. He does not undertake the execution of civil works. The several departments of Government are permitted to address him direct, and his services are being utilized to an increasing degree by them.

An extension of the policy of specialization appears advisable in the case of architectural and town-planning work, and it is considered that the quality of work might be considerably improved if the Consulting Architect were in certain cases to undertake the supervision of work with the aid of an Architectural Assistant. The services of skilled English Foremen might be entertained for short periods to diffuse among the local *mistris* improved methods of working.

Electrical.—There is an Electrical Engineer to the Local Government who also performs the duty of an Electric Inspector under the Electricity Act. He is assisted by an Assistant Electrical Engineer. He is an executive officer and undertakes the execution of electrical works, and the preparation of electrical projects, both for the Local Government and for local bodies. His services have been much in request by Native States desiring to initiate electrical schemes.

The remaining branch is that of the Civil Engineers who of course form the main bulk of the Department.

As regards their *inter se* relations the Sanitary Engineer, Consulting Architect and Electrical Engineer may be regarded as the specialists in the Department, and the relations between them and the remainder of the Department are entirely satisfactory.

With the gradual introduction of more up-to-date methods, however, it is felt that the duties of these "Specialists" will become more and more onerous, and an enlargement of their respective branches and the introduction of other specialists is inevitable if the present system for carrying out Public Works is retained.

V.—*Whether further decentralization within the Public Works Department itself is desirable, and if so, to what extent and in what direction.*

It is not considered that any further decentralization within the Public Works Department is desirable. The scale of responsibility attached to the various ranks of the Department is suitable.

VI.—*Whether the Public Works Department Code, which regulates the execution and maintenance of Civil Works, is unduly restrictive, and if so, in what direction change is desirable.*

This issue appears to be intimately connected with the first point dealt with above. It is not considered that the Public Works Department Code, as altered to date, is unduly restrictive in any way. A new edition of the Public Works Department Code, embodying all the many alterations made since last edition, is urgently required and in such revision further simplification would doubtless be found feasible.

VII.—*Whether the system of education in Government Engineering Colleges is organised on a sufficiently broad basis to meet the needs of private agency as well as of Government. Whether it attracts suitable candidates, and whether the standard of instruction is sufficiently advanced to provide fully qualified Civil Engineers for employment by Government, Local Bodies and private engineering and contracting firms, and if not, in what directions, and to what extent, improvement is required.*

Since the abolition of Cooper's Hill there are no Government Engineering Colleges in England, so this item concerns solely the existing institutions in India.

With the present conditions of supply and demand it is considered that the existing system is satisfactory and meets with the necessary requirements.

With the steady advance in the science of engineering the necessity for keeping the curriculum of our colleges up-to-date is obvious and it is presumed that this is being done. With the existence of caste and social prejudice in this country it is considered that the present system of training engineers and upper and lower subordinates in the same institution is perhaps open to criticism, and it is suggested that Engineering Colleges should confine themselves to the training of engineers only, subordinates being relegated to other smaller institutions. This however is too large a question to be fully discussed in this memorandum.

VIII.—*Whether adequate provision is made for the practical training on works of students who have received their scientific education in English or Indian Colleges.*

In the practical training of students on works there are certain difficulties. The Executive Engineers employed on the most important works are usually very busy men, and they have little time to spare for the tuition and guidance of apprentices. Moreover good executive officers do not always possess the qualities necessary to a teacher.

However it is considered that Government should undertake this duty, and, having done so, should carefully consider the best ways and means to give the student every opportunity of acquiring experience. To this end it is necessary for the Chief Engineer to consider carefully that the executive officer is suited to the task. An honorarium might be paid to the officer if the student is considered to have spent his time advantageously. The student might during his period of practical training be entrusted with actual duties to perform carrying some small measure of responsibility with them.

The extent to which Government should undertake this provision of practical training need be limited only by the numbers of officers suited to the duty, and the existence of suitable works in progress.

With the rapid strides that are being made in engineering science it is a matter for serious consideration whether greater encouragement should not be given to officers, when on leave at home, to bring themselves up-to-date, by studying the latest methods and practices. A system of "Study Leave" on the lines of leave granted to officers of the Indian Medical Service would have many advantages especially in view of the tendency to which reference has previously been made of specialising in the various branches of Civil Engineering. Officers having in this way gained specialised knowledge will be able to impart it to junior officers and students training under them and thus encourage young engineers to continue learning their profession and avoiding the tendency to stagnate which unfortunately is rather common in this country.

APPENDIX V.

Memorandum prepared by the Chief Commissioner of the Delhi Province.

(2). In Northern India, at all events, work is carried out almost entirely through the agency of piece-workers.

There is very little direct departmental work, nor is it usual to employ contractors, in the sense in which the word is understood in Europe. Though the work is,

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in the main, efficiently carried out, the system requires the maintenance of a large supervising establishment, and it carries with it two very pronounced disadvantages. In first place, the efforts of the supervising establishment are frequently wasted in carrying out operations which do not require a highly trained and specialized establishment. The consequence is not only a waste of power but a loss of efficiency, in so far as the procedure as to estimating, accounting, etc., which might not be out of place when applied to a large and costly work, is altogether unnecessary when applied to works of minor importance. In the second place, the system, in so far as it places the whole of the public engineering work of the country in the hands of a Government department, tends to check the growth both of private engineering enterprise and of a body of reliable contractors, capable of designing and executing works of any importance.

(3). The system is not, of course, directly due to the action of Government; it has grown up out of the necessities of the situation. We have had to face in the past not only an entire lack of educated labour, capable of designing and executing public works, but a low standard of morality in the labouring class which prevented it evolving men who could be trusted to carry out work with a reasonable degree of honesty. But in the interval since the Public Works Department was founded, circumstances have arisen which in my opinion require us to attempt to work gradually up to a system of 'contracting' in the proper sense of the term. It is not to be expected that the change, if it can be effected, can be more than gradual. It will obviously be many years before we can with safety rely on a procedure under which our Public Works Officers can sketch out the main lines of a work and call for tenders for its detailed design and its execution. This would imply that contractors should maintain their own engineering staff, or should at all events themselves have some engineering training. We cannot expect this, unless contracts of considerable importance are given to them; and it is just these contracts which cannot be given to firms which have no better equipment than the contractor as we now know him. Even, therefore, if we should ultimately be successful in introducing a more complete 'contracting' system, there must be a transitional period, possibly for considerable duration, during which contractors are gradually making themselves fitted for taking up work on other than a purely piece-work basis.

(4). The case for a change in procedure however appears to be very strong. It is advisable on political grounds, since it will afford a wider opening for educated Indians in private as apart from Government work; and it is advisable on grounds of ultimate efficiency, since it will encourage the specialization in the building and engineering trades without which any real advance is impossible. I feel the latter argument to be a very strong one. One cannot for instance help being struck at present by the absence of men of the foreman class, capable of doing good work whether in bricklaying, stonework or carpentry. The responsibility for supervising such work now rests with a Government Engineer; he has at his disposal men with a general training, very often purely theoretical, and it is useless in the circumstances to expect really good detailed work from the piece-worker. There is no one with expert knowledge either to instruct or supervise the workmen; and the consequence is that whatever the general merits of the work carried out by the Public Works Department, the actual details are frequently very bad indeed. I fancy that in regard to sanitary work, the need for which is increasing every day in India, the case is likely to be still worse unless we can encourage the growth of reliable contractors. Here the result of bad work is not so much an aesthetic misfortune, as a positive danger to health.

(5). The preliminary steps which I would advocate to secure the gradual devolution of work to contractors would be (1) the undertaking of the greater part of repair work on buildings of the civil departments concerned, (2) the calling for tenders for all small works for which standard plans exist; (3) the refusal to carry out 'con-

tribution works' for private bodies. These steps, which seem obvious, and call for no explanation, might be followed in time by calling for both designs and estimates for larger works of which the plans present little real difficulty, such as district offices, jails, and police stations.

(6). It would probably in the first instance be necessary to accept the position that there would be no financial gain in this procedure; indeed it is likely that there would be some financial loss, since until there is sufficient competition among competent contractors, there would be little likelihood of the better men working to present rates. We should have to look to the possibility of securing lower rates when a state of full competition is established. We should also in the first instance probably have to face some decline in efficiency, but this is a feature which we have had to face—and shall have to face increasingly in the future—in pursuit of the policy of creating wider openings for Indians.

(7). The gradual extension of this policy would of course, result in our ultimately maintaining our Public Works Department in a supervising and consulting capacity rather than as an executive body. It has been suggested in some quarters, that we should, in order to facilitate the transition to this stage, entrust a larger share of Government work to local body engineers. My own experience tells against this proposal. I am naturally in favour of any procedure which would require local bodies to employ engineers of definite qualifications, but the resources at the disposal of local bodies in Northern India do not as a rule allow them to employ men of any considerable professional standing. It has been suggested that they should be grouped together in order to allow them to employ men of a better class. I do not think this feasible. The divided responsibility which this proposal involves would ultimately result in trouble which could only be solved by placing the local body engineers under some central authority, say the Commissioner, and lending their services to a group of Boards or Municipalities. The result would be the creation of a secondary Public Works Service, practically in the employ of Government, but with so small a cadre as to offer no prospects to good men. And it would certainly do nothing towards the creation of an independent engineering profession. The proposal seems to offer far less prospect of ultimate success than the alternative already discussed, viz., deliberately to face the loss of efficiency and economy which might result from allowing civil and departmental officers to offer at first small and then larger works to public tender among private practitioners, under the general supervision of a Government Consulting Engineer.

(8). It is a matter for consideration whether it should not be laid down that in giving out all contracts over a certain limit, the contractor should employ an engineer of specified qualifications. I feel strongly that no progress can be made in developing a really reliable class of contractors so long as they remain, as at present, mere purveyors of labour. Some of them have acquired by experience a certain rough and ready acquaintance with the methods of building and road making; but the majority limit their attainments to the science of dealing unfaithfully with Public Works Department subordinates and ministerial officers. If we are to get rid of the subordinate engineering establishment and at the same time to encourage the growth of the private practitioner, it appears to me obvious that we must compel the contractor to employ a skilled engineering subordinate.

(9). I now turn to certain minor points which are discussed in the Resolution under reference. The relations *inter se* of the various sub-divisions of the Buildings and Roads Branch, Sanitary, Architectural, and Electrical engineering, are not at present unsatisfactory, but I think that there would be a considerable gain in bringing them all to one regular cadre. The fact that special conditions and rates of pay apply to some of these posts must always tend to make some difference in the relations of the holders with other members of the service. I should, with Mr. Keeling, prefer to see the Chief Engineer called the Director of Public Works; and I think

APPENDIX V—concluded.

he should be given definite sanctioning powers as the head of a department. At present he appears to possess powers only as a Secretary to a Local Government. I also think that it would be advisable to mark more definitely than is done in some provinces, the direct subordination of the Architect, Sanitary Engineer, and Electric Inspector to the Director of Public Works. We have found it advisable in the Delhi Administration to treat these officers purely as designing and inspecting officers subject to the Chief Engineer, and the system appears to have obvious advantages.

(10). As regards the question of further decentralization within the Public Works Department, as at present constituted, I think there are few among those who have had to work in close connection with the Public Works Department who do not feel that the present system of working is unduly cumbrous. Apart from minor restrictions in regard to such expenditure as stationery, printing, etc., in which the Public Works Department seems to have secured less devolution than other civil departments, I think that considerably increased powers should be given to Executive Engineers in regard to appointment of work charged establishment. Their power should also be increased in respect of contracts, as to which the limit is now Rs. 5,000 though here I would insist that the Executive Engineer should be obliged in every case to call for tenders by public advertisement. Nothing, in my opinion, is likely to improve the present conditions regarding contracting so much as public calling for tenders. I am also in favour of giving increased powers to Superintending Engineers in regard to technical sanction. I doubt whether a review of a large number of estimates which have come up to the Local Government for technical sanction would reveal many modifications of importance in their details; while the delay incidental to their examination is a matter of common experience. The civil heads of departments who deal with applications for administrative sanction, frequently find works held up for long periods during which the elaborate procedure for technical sanction is being carried out, and it is very doubtful whether the gain in efficiency affords any real compensation for the obvious disadvantages of the present procedure.

(11). It is a little difficult to answer the question whether the Public Works Code is unduly restrictive, because it has become exceedingly difficult for anyone who is not gifted with the patience of an antiquarian, to discuss the rulings of this obscurantist publication on any particular point. It is an unpleasant commentary on the business capacity of the Indian Government that

it should have for so many years attempted to regulate the actions of an important department by this farago of ill-arranged and ill-digested regulations. But as regards details I would point out as unduly restrictive the ruling requiring an estimate for all kinds of work, since it is clear that there are many minor items and expenditure which do not require to be dealt with under the formal estimate procedure; and I should also be prepared to allow the Superintending Engineer a freer hand in reappropriating funds from one work to another. It appears to me that the departments concerned would be better served by a statement from him showing the progress of those works affecting them which are entrusted to him, than by being consulted as regards the reappropriation of funds from one work to another. If they find that a work is unnecessarily delayed they have their remedy in a complaint to the Chief Engineer; whereas the necessity for applying for reappropriation of funds leads to much infructuous correspondence and is liable to involve lapses towards the end of the financial year. I have already noted on the necessity for granting increased powers in respect of establishments charged to works; I understand that much difficulty is experienced on account of the restrictions imposed in this respect.

(12). I have not a first hand acquaintance with the work of audit as applied to the Public Works Department, but the complaints on this subject are so common among the engineering staff, that I hope that the Committee will take the opportunity to overhaul the system. If the complaints which one hears are correct—and they are so universal that they cannot be without foundation—the audit system is both cumbrous and inefficient as a real check audit. I admit that in the case of the Delhi Administration these complaints are less common because we have here a system of pre-audit—based on that introduced at the instance of the Durbar Committee in 1911 in regard to Durbar Expenditure which dispenses with much correspondence, and gives us the services of an Audit Officer whose personal contact with the Executive Officers removes many of the objections felt elsewhere. His inspection notes have also been of great value to the Local Administration. But I am strongly of opinion that where one is dealing as in the case of the Public Works Department, mainly with non-recurring expenditure, a check audit something of the type of that carried out by the better class of local fund auditors is of more use than the purely accounts audit now maintained for Public Works accounts.

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